ABSTRACT

Title of Document: SCALE DEVELOPMENT AND DIMENSIONALITY ANALYSIS OF A PROTECTIVE BEHAVIORAL STRATEGIES MULTI-ITEM SCALE FOR USE WITH COLLEGE STUDENT DRINKERS

Melinda Ann Griffin, Doctor of Philosophy, 2008

Directed By: Professor Bradley Boekeloo
Department of Public and Community Health

Protective behavioral strategies (PBS) have been defined as self-control behaviors individuals practice prior to, during, and/or after drinking to limit consumption and/or the negative consequences. Although a multi-item PBS measurement scale has been used in the research literature, the psychometrics, reliability, and validity of the PBS scale needed further examination. This study examined the 1) dimensionality of the PBS scale for self-identified college student drinkers as well as for gender and race/ethnicity subgroups, 2) internal consistency and test-retest reliability of the PBS sub-scales, and 3) construct validity of the PBS sub-scales. College students who self-reported as recent alcohol users (n=320) on a web-based survey administered during fall semester of the 2006 academic school year comprised the study sample.

Factor analysis was utilized to determine the underlying factor structure of 22 item PBS scale. Additionally, congruence of the factor structure among gender and racial sub-groups was examined by rotating the sub-groups' matrices via the Procrustes orthogonal method. Reliability analysis was utilized to determine the internal consistency

of the PBS sub-scales. Separate multiple linear regressions were performed to determine the construct validity based on relationships between the PBS sub-scales and potential motivations (refusal self-efficacy, protection self-efficacy, drunkenness avoidance self-efficacy, alcohol abstinence expectations) and potential alcohol-related outcomes (multiple alcohol use items, negative consequences) while controlling for gender and race.

Examination of the output from repeated factor analyses, Procrustes rotation, and reliability analyses resulted in a 2-factor solution with 17 items. Both PBS sub-scales (Planning and Execution) had acceptable internal consistency across all samples and acceptable test-retest reliability. Construct validity of the Execution PBS was fully supported whereas the Planning PBS was partially supported. Specifically, the Planning PBS sub-scale was highly correlated with protection and drunkenness avoidance self-efficacy as projected but not alcohol-related outcomes. The Execution PBS sub-scale was highly correlated as projected with refusal, protection and drunkenness self-efficacy, alcohol use, and negative alcohol effects. Special attention was given in this study to PBS construct validity considering potential PBS motivations and PBS scale dimensionality across gender and race subgroups. This study contributes to parallel research attempting to identify a definitive, standardized measure of PBS.

SCALE DEVELOPMENT AND DIMENSIONALITY ANALYSIS OF A PROTECTIVE BEHAVIORAL STRATEGIES MULTI-ITEM SCALE FOR USE WITH COLLEGE STUDENT DRINKERS

By

Melinda Ann Griffin

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2008

Advisory Committee:
Professor Bradley Boekeloo, Chair
Professor Kenneth Beck
Associate Professor Donna Howard
Assistant Professor Nancy Atkinson
Associate Professor Kevin O'Grady

Acknowledgements

I must take this opportunity to extend my gratitude to Dr. Bradley Boekeloo for his guidance, mentoring, patience, and commitment to me while I completed this study. Dr. Boekeloo has allowed me to mature not only as a researcher but also as a person by continually challenging me and allowing me to grow through this process. I would also like to thank the rest of my committee: Dr. Donna Howard, Dr. Kenneth Beck, Dr. Nancy Atkinson, and Dr. Kevin O'Grady. Each of these individuals was chosen because of their incredible support and enthusiasm and because of their willingness to guide me through this process. I will take something very special from each of them and will forever be grateful for their participation in my academic career.

Lastly I must thank my loved ones. My parents, Darrell and Norma, have taught me to never give up and to trust that I can accomplish anything. They are the two hardest working people I know, and I strive to make them proud by living up to the example they have set. My entire family has given me unconditional love and support during this process, and I thank them for that. Finally, I have to thank the love of my life, Mark Novik. He is not only my husband but also my best friend. He has stayed by my side and has given me the emotional support, encouragement, and motivation I needed when I did not believe in myself. He has not only been my biggest cheerleader but also the rock on which I have leaned during my most difficult times. I am thrilled that I am able to share this wonderful accomplishment with him and with the rest of my family.

This study was supported by the National Institute on Alcohol Abuse and Alcoholism grant # R01AA015139-01A1.

Table of Contents

Chapter 1: Introduction
- Overview of the Problem……1
- Hypothesized Framework……4
- Specific Aims and Hypotheses…… 7
- Key Variables/Definitions……..…… 10
- Significance of Research……..12

Chapter 2: Review of Relevant Literature and Background
- Alcohol Use and Related Problems……..17
- Theoretical Foundation of PBS as a Construct……22
- Existing PBS Measures……27
- Additional PBS Items…….. 31
- Approaches to Determining the Dimensionality of Multi-Item Scales……35
- Approaches to Determining the Reliability and Validity of Multi-Item Scales.. 37
- Prior Reliability and Validity Testing of PBS Measure…….. 40
- Study Conceptual Framework for Testing the Validity of the PBS Scale……...43

Chapter 3: Methods
- Research Design…….. 51
- Sampling Procedure……53
- Participation Flow Chart…… 48
- Recruitment……..55
- Instrument…… 58
- Survey Administration……66
- Data Collection Procedures……..68
- Response Rates…… 68
- Data Cleaning/Management…… 70
- Delimitations……71
- Assumptions…… 71
- Analysis Plan…….. 72
- Missing Data…… 89
- Power/Sample Size……..……... 90
- Human Subjects Procedures……..……. 90

Chapter 4: Results
- Missing Data……..…….. 92
- Characteristics of Study Sample…….. 95
- Descriptives…… 100
- Specific Aim #1……. 109
- Specific Aim #2……. 128
- Specific Aim #3……. 131

Chapter 5: Discussion
Interpretation of the PBS Dimensionality, Reliability and Validity Testing……137
Relationship of the Findings to the Recent Literature …… 140
Limitations……143
Summary and Implications of the Current Study…… 146
Recommendations for Future Research……151
Conclusions…… 152

Appendices
A. Follow-up Survey #1, paper version with consent form
B. UM IRB Approval

Bibliography

List of Tables

Table 2.1. Illustration of Existing and New PBS Items……34
Table 4.1. Missing Cases: Characteristics and Action Taken FU1…….. 93
Table 4.2. Missing Cases: Characteristics and Action Taken FU2…….. 94
Table 4.3. Characteristics of Participants vs. Non-Participants (all students) FU1..95
Table 4.4. Characteristics of Participants vs. Non-Participants FU2 Control Group Only……. 97
Table 4.5. Characteristics of Drinkers vs. Non-Drinkers FU1…… 98
Table 4.6. Characteristics of Drinkers vs. Non-Drinkers FU2 Control Group Only 99
Table 4.7. Mean, Standard Deviation, Number Missing of PBS Items ……102
Table 4.8. Mean, Standard Deviation, Number Missing of Self-Efficacy Items..…..105
Table 4.9. Mean, Standard Deviation, Number Missing of Alcohol Abstinence Expectancies…….106
Table 4.10. Mean, Standard Deviation, Number Missing of Alcohol Use Items….. 107
Table 4.11. Mean, Standard Deviation, Number Missing of Personal Consequences.108
Table 4.12. Descriptives of Key Variable Indices ……..……108
Table 4.13. Pearson Product-Moment Correlation Coefficients between PBS Items.111
Table 4.14. Rotated Factor Loadings based on Forced 4-Factor Structure of PBS Items, Total Sample……119
Table 4.15. Residual Matrix and Coefficients of Non-Determination for Forced 4-Factor Solution…….120
Table 4.16. Reliability Based on 4-Factor Solution…….……..121
Table 4.17. Rotated Factor Loadings based on 3-Factor Structure of PBS Items…..123
Table 4.18. Residual Matrix and Coefficients of Non-Determination for 3-Factor Solution……123
Table 4.19. Reliability based on 3-Factor Solution……124
Table 4.20. Eigenvalues with Percent of Variance Explained of PBS items, Total Sample……125
Table 4.21. Residual Matrix Factor Loadings for Forced 2-Factor Solution…….126
Table 4.22. Factor Structure: PBS Rotated Factor Loadings, FU1 Total Sample…..127
Table 4.23. Item Statistics for Total Sample, Planning PBS……..……128
Table 4.24. Item-Total Statistics for Total Sample, Planning PBS……129
Table 4.25. Item Statistics for Total Sample, Execution PBS……129
Table 4.26. Item-Total Statistics for Total Sample, Execution PBS……..129
Table 4.27. Cronbach's Alpha Coefficient for all Sub-Samples……130
Table 4.28. Mean Differences in the Summed PBS Sub-Scales Scores, Mean (Standard Deviation); FU1……132
Table 4.29. Multivariate Linear Regression with Final PBS Sub-scales……136

List of Figures

Figure 1.1. Theoretical Framework with Expected Correlational Relationship…….7
Figure 1.2. Exploratory Correlation Matrix Identifying Expected Relationships…..9
Figure 3.1. Parent Study Participation Flow Chart…… 55
Figure 4.1. Scree Plot Illustration of Eigenvalues, Total Sample……..126
Figure 4.2. Revised Correlation Matrix Identifying Expected Relationships……133

Chapter 1: Introduction

Overview of the Problem

This study aimed to improve measures of a Protective Behavioral Strategies (PBS) construct for reducing the risk of alcohol use among college student drinkers. Alcohol use behaviors among college students continue to be a problem that many college administrators and researchers investigate and try to address while maintaining a zero tolerance message for underage students. Not only are most college students under the legal drinking age, but alcohol use also leads to many negative consequences such as death, motor vehicle accidents, suicidal ideations, mental health problems, interpersonal problems, academic and financial problems, and other physical maladies (Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994; Perkins, 2002; Park, 2004; Hingson, Heeren, Winter, & Wechsler, 2005). The U.S. Department of Health and Human Services (DHHS) had included alcohol-related objectives in their publication: Healthy People 2010. Those objectives specific to alcohol related behaviors of adolescents include "increase the proportion of adolescents not using alcohol or any illicit drugs during past 30 days" and "reduce proportion of adults engaging in binge drinking of alcohol during past month" (DHHS, 2000).

Many alcohol studies conducted in recent years have focused solely on establishing the prevalence of this problem (CAS: Wechsler et al., 1994; NCHRBS: CDC, 1997; CORE: Perkins, 2002; NHSDA: SAMHSA, 2004; MTF: Johnston, O'Malley, Bachman, & Schulenberg, 2005). Moreover, past intervention efforts that have attempted to promote abstinence, have provided only education, or focused on normative approaches that have not had significant long-term effects on national drinking

behavior as evidenced by the stagnant rates of consumption in the past 20 years (Wechsler et al., 1994; CDC, 1997; Walters & Bennett, 2000; Perkins, 2002; Ham & Hope, 2003; SAMSHA, 2004; Johnston et al., 2005; CDC, 2006). While abstinence from alcohol use has been a major programmatic goal in most past intervention programs, this approach has shown to be of limited effectiveness. Some researchers (Marlatt, Somers, & Tapert, 1993; Benton, 2004; Martens, 2004; Delva, 2004) have recently focused on behavioral-cognitive strategies that students can employ when they are drinking to help reduce the amount they consume and/or the negative problems that are so often associated with alcohol use. While researchers and college administrators cannot condone underage drinking, there seems to be a need for helping students to stay safer if they choose to consume alcohol and give them the power to make responsible decisions with regards to their alcohol use behaviors. For students who choose to drink alcohol, regardless of the legality of their behavior, risk reduction strategies may be critical in decreasing the problems from alcohol use.

Based on a harm reduction model (Marlatt et al., 1993; Marlatt, 1996) aimed at minimizing the negative effects of certain health behaviors, PBS had been identified and measured with self-reported questionnaire items. Marlatt et al. (1993) posited that all health behaviors and the related consequences can be placed upon a continuum of risk. Therefore, the concept behind the alcohol PBS is that drinkers who use them can move along the continuum from more risky to less risky behaviors and associated consequences. PBS as a harm reduction approach may prove more effective with college students who drink than an abstinence only approach.

Recently, Martens et al. had preliminarily explored the dimensionality of a PBS scale but acknowledged that it needs more psychometric analysis and further validation (Martens, Ferrier, Sheehy, et al., 2005). With regard to validity, the ability of PBS to correlate with reductions in alcohol use and negative effects of alcohol use needed to be established further. The PBS measure also needed to be examined with diverse college student populations. A scale must go through repeated analyses with different cohorts of students to be accepted as a standard measure for use and comparison across multiple studies and the PBS measure had not yet achieved this level of scrutiny. More research needs to be conducted on these items to fully understand the dimensionality, reliability, and validity of this set of PBS items in different college student populations. Additionally, prior analysis suggested that the PBS scale has meaningful and interpretable sub-scales. Further sub-scale validation is needed (Martens et al., 2005). Once a reliable and valid scale, perhaps with meaningful sub-scales, has been developed, future intervention studies can be more reliably evaluated with these measures.

The genesis of this secondary analysis study focusing on the PBS utilized by college student drinkers was from experience during the developmental phase of the primary study, Peers as Family: Preventing Problem Drinking (PAF). PAF was an alcohol risk reduction intervention implemented with college students residing in campus dormitories. During the development of the survey used to collect data for PAF, the research staff was faced with the inability to find an existing standard set of PBS for use in the evaluation of this intervention (PAF, 2005). Two sets of PBS items had been used in published studies (CAS: Benton et al., 2004; ACHA, 2005). However, no methodological, theoretical, or heuristic information pertaining to these items was

provided. Also, it appeared that the PBS items focus on different outcomes: abstinence, amount of alcohol use, or effects of drinking. Additionally, the theoretical mechanisms of change across the PBS items were most likely different based on the outcomes of interest.

Given that the PBS items had been used in multi-item scales to measure the PBS construct and the scales appear to be multi-dimensional, psychometric analysis of the multi-item PBS measure was needed to provide further support to their reliability and validity for use in research and evaluation. This study examined the dimensionality and psychometric properties of the 22 items compiled from existing literature along with additional items developed to improve the construct measurement. Ten items were from the National College Health Assessment (ACHA, 2005), five were from the Campus Alcohol Survey (Benton et al., 2004), while the remaining seven items were based on students' responses during focus group discussions (Howard, Boekeloo, Griffin, Lake, & Bellows, 2007). These items collectively will be referred to as 'PBS'. If shown reliable and valid, the PBS scale can serve an important role in the development of alcohol problem prevention programs with demonstrated effectiveness. A reliable and valid PBS scale can improve the validity of program demonstration and evaluation projects and research on the mediating mechanisms for reducing alcohol-related problems.

Hypothesized Framework for Testing the Validity of the PBS Scale

Based upon initial face validity analysis of the construct validity of the PBS scale by the "Peers as Family" research team, including behavioral science and alcohol education expertise, and specific responses from the in-depth student focus group

discussions conducted as part of the "Peers as Family" project (Howard et al., 2007), it appeared that the PBS items may relate differently to three different prevention strategies and therefore, may form three separate but inter-related clusters of items. These three apparent clusters were referred to as the hypothesized PBS sub-scales. However, the final scale structure resulting from the dimensionality analysis may vary from the hypothesized sub-scales. The three hypothesized sub-scales appeared to focus separately on the three prevention strategies of alcohol avoidance, responsible drinking, and avoiding unsafe environments. The three sub-scales appeared to separately be related to two outcomes: abstinence and negative effects of drinking. Furthermore, the three sub-scales and outcomes were likely to be influenced by different mechanisms of change, or predictors. These hypothesized relationships between predictors, sub-scales, and outcomes are illustrated in Figure 1: The Theoretical Framework. This Theoretical Framework gives an overall context with which to understand the dimensionality, reliability, and validity of the PBS scale. The rationale for the proposed relationships in the Theoretical Framework is provided in the Background Section, Chapter 2. In this study, the Theoretical Framework was examined through the testing of hypothesized relationships between variables based upon the following hypothesized correlation matrix of relationships illustrated in Figure 2. It was important to note that the goal of this study was not to identify the most parsimonious predictive model of the designated outcomes in the Theoretical Framework. Rather, the multiple variable relationships proposed in the hypothesized correlation matrix below were examined to gain a better understanding of the dimensionality, reliability, and validity of the PBS scale. The logic of the correlation

matrix was based on the Theoretical Framework but the Theoretical Framework itself was not tested for its predictive value.

Because additional items had been added to those PBS items found in the literature (Benton et al, 2004; Delva et al., 2004) and the PBS scale had not been examined in relation to theoretical mechanisms for changing PBS, this dimensionality, reliability, and validity testing is necessary to confirm the utility of the PBS scale. Hence, the correlation matrix below indicates the hypothesized relationships between measures that will be examined in this study. Data from self-identified college drinkers in the "Peers as Family" study was used for this secondary data analysis. As the correlation matrix illustrates, there were hypothesized PBS sub-scales, sub-scale predictors, and sub-scale outcomes which were examined to elucidate the dimensionality, reliability, and validity of the overall PBS scale. Specifically stated, the PBS sub-scales were the main variables of interest in this study. Alcohol abstinence expectations, refusal self-efficacy, protection self-efficacy, and drunkenness avoidance self-efficacy were used as independent variables when examining the PBS sub-scales as dependent variables. The PBS sub-scales were then used as the independent variables when examining alcohol use and negative alcohol effects as the dependent variables.

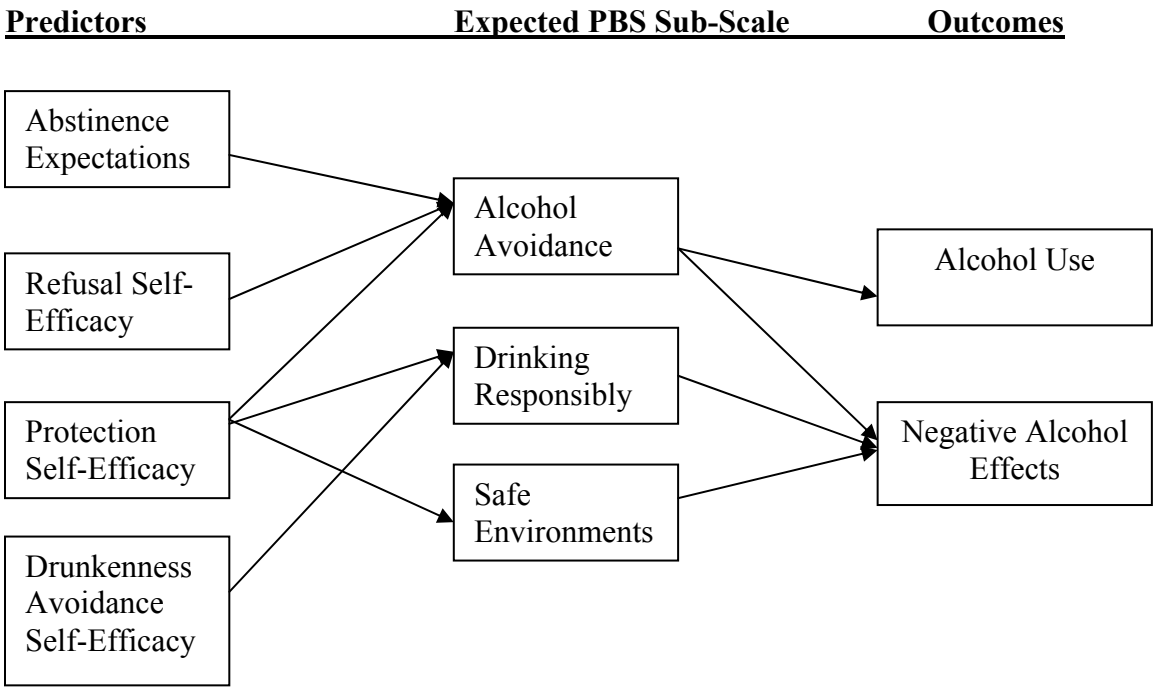

Figure 1.1. Theoretical Framework with Expected Correlational Relationships

Specific Aims and Hypotheses

As previously alluded, this study aimed to add to the current literature regarding alcohol harm reduction by exploring the psychometrics, including reliability, validity, and dimensionality of a PBS scale. Interpretable and meaningful sub-scales were identified through factor analysis. Each sub-scale will then be examined for internal consistency and test-retest reliability. In addition, each sub-scale was examined to identify the convergent and discriminant validity of the individual PBS sub-scales as well as the convergent validity guided by the above-illustrated correlation matrix. If a reliable and valid PBS scale, or set of sub-scales, is identified, then this measure can be used to enhance the reliability and validity of future research and evaluation.

The specific aims and hypotheses of this study were to:

Aim#1: Examine the dimensionality of the PBS scale for all students and for gender and race/ethnicity subgroups.

Hypothesis #1: The PBS items will represent a multi-dimensional scale.

Aim #2: Examine the internal consistency and test-retest reliability of the PBS scale, and/or sub-scales

Hypothesis #2: The PBS scale will represent a reliable measure.

Aim #3: Examine the construct validity among the PBS sub-scales and between the PBS sub-scales and the predictors and outcomes for all students.

Hypothesis #3a: Alcohol avoidance PBS was expected to converge on the theoretical predictors and outcomes of alcohol abstinence expectations, refusal self-efficacy, protection self-efficacy, alcohol use, and negative alcohol effects and were expected to discriminate from the theoretical predictor drunkenness avoidance self-efficacy.

Hypothesis #3b: Drinking responsibly PBS was expected to converge on the theoretical predictors and outcomes of protection self-efficacy, drunkenness avoidance self-efficacy, and negative alcohol effects and were expected to discriminate from the theoretical predictors and outcomes of alcohol abstinence expectations, refusal self-efficacy, and alcohol use.

Hypothesis #3c: Safe environments PBS was expected to converge on the theoretical predictors and outcomes of protection self-efficacy and negative alcohol effects and were expected to discriminate from the theoretical predictors

and outcomes of alcohol abstinence expectations, refusal self-efficacy, drunkenness avoidance self-efficacy and alcohol use.

	Alcohol avoidance	Drinking responsibly	Safe environments
Drinking responsibly PBS	**R**		
Safe environments PBS	**R**	**R**	
Alcohol abstinence expectations	**R**	X	X
Refusal self-efficacy	**R**	X	X
Protection self-efficacy	**R**	**R**	**R**
Drunkenness avoidance self-efficacy	X	**R**	X
Days use beer	**R**	X	X
Days use liquor	**R**	X	X
Days use alcohol of any type	**R**	X	X
Days binge	**R**	X	X
Weekly use	**R**	X	X
Negative alcohol effects	**R**	**R**	**R**

Figure 1.2. Exploratory Correlation Matrix Identifying Expected Relationships

R indicates expected significant relationship (convergent validity).
X indicates no expected significant relationship (discriminant validity).

It was important to clarify that if the PBS scale is indeed multidimensional, the individual sub-scales will be retained and utilized for additional reliability and validity analyses. Specific aim #3 was intended to identify whether the individual sub-scales are correlated and can be utilized in combination with each other as a true multi-dimensional PBS scale or if the individual sub- scales are uncorrelated and should be treated as separate, unique constructs. The decision as to how many sub-scales (if any) to retain are explained in further detail in Chapter 3.

Key Variables/Definitions

Protective Behavioral Strategies: Self-control behaviors individuals practice prior to, during, or after drinking to either limit consumption or the negative consequences associated with alcohol use (Benton et al., 2004; Delva et al., 2004; Martens et al., 2005).

Alcohol use: The consumption of a standard drink of beer, wine, liquor, or alcohol of any type within a designated reference period.

Drinker: A college student who has self-reported alcohol use (beer, wine, liquor, alcohol of any type) within the 30 days prior to survey administration (PAF, 2005).

Living-Learning Membership: Special groups in which students with similar academic interests follow the same academic program and live together in campus residence halls.

Negative Alcohol Effects: Those personal, interpersonal, and environmental negative effects that a person experiences as a result of their own alcohol use (Park, 2004).

Alcohol Abstinence Expectations: Those behavioral and/or social effects thought to result from refraining from consuming alcohol (PAF, 2005).

Self-efficacy: The confidence in which a person believes he/she can perform a behavior (Bandura, 1986).

Refusal Self-efficacy: One's confidence in their ability to decline alcohol in certain situations (Oei, Hasking, and Young, 2005).

Protection Self-efficacy: One's confidence in their ability to use specific protective behavioral strategies to socialize responsibly when in drinking situations (PAF, 2005).

Drunkenness Avoidance Self-efficacy: One's confidence in their ability to use specific protective behavioral strategies to avoid drinking in excess (PAF, 2005).

Dimensionality: The number of factors extracted from a set of variables based on factor analysis (Hair, Anderson, Tatham, and Black; 1998).

Construct Validity: The degree to which inferences can legitimately be made from the operationalizations to the theoretical constructs on which the operationalizations are based (Trochim, 2001).

Internal Consistency: The overall degree to which the items that make up a scale are inter-correlated (Clark & Watson, 1995).

Test-retest Reliability: The correlation between successive measurements on a set of objects with respect to a variable (Kachigan, 1991).

Convergent Validity: The operationalization's ability to distinguish between groups it should theoretically be able to distinguish between (Trochim, 2001).

Discriminant Validity: The degree to which the operationalization's was not similar to other operationalizations that it theoretically should be not similar to (Trochim, 2001).

Multiple Regression Coefficient (R): The correlation between the set of composite scores and the scores on the criterion variable (Kachigan, 1991).

Procrustes Rotation: A least-squares problem of transforming a given matrix A into a given matrix B by an orthogonal transformation matrix T so that the sums of squares of the residual matrix E = AT-B is a minimum (Schönemann, 1966).

Residual Matrix: A matrix of coefficients representing variance not accounted for by the first factor (Gorsuch, 1983).

Coefficient of Non-Determination: the proportion of variance not explained by the variables of interest (Hair, 1998).

Significance of Research

It has been documented that there are numerous personal, interpersonal and community problems that may result from individual alcohol use. The easiest way to protect one-self from the negative consequences is to abstain from drinking. However,

this should not be the primary goal (Marlatt et al., 1993; Single, 1996) as it was not a realistic goal for many college-aged drinkers. While many researchers have focused on cutting down the frequency and quantity of student alcohol consumption, the ultimate goal of interventions is often to get students to abstain from drinking altogether. However, the decision to abstain was not typically a choice many college students allow themselves and preaching abstinence only may actually cause students to "rebel" and engage in risky drinking to spite authorities (Marlatt, 1996). There are also many positive consequences or expectations of drinking that a student may consider when making the decision to drink such as reduced inhibitions, easier ability to socialize with others, and the feeling of fitting in (Fromme & Corbin, 2004). Therefore, there are thousands of college students across America who may not be old enough to legally consume alcohol, but who make the decision to drink and among whom abstinence was not a feasible choice. For those students who do make the decision to drink, it was important that they be armed with such skills and strategies to help limit the amount they drink and possibly reduce their likelihood of experiencing the many negative consequences associated with alcohol use (Marlatt et al. 1993; Single, 1996; Sale, Sambrano, Springer, & Turner, 2003).

Protective behavioral strategies are those strategies or skills that students can use after they have made the decision to drink. The idea behind the use of PBS is that of harm reduction or minimization (Single, 1996). The decision to use PBS can be employed prior to going out, while out partying or socializing, and/or after one has ceased drinking. Therefore, these PBS cover all levels of prevention: primary, secondary, and tertiary. These strategies may also be seen as empowering for those students who

make the individual choice to drink because they serve to arm individuals with the knowledge and behaviors to make the best decisions possible (Marlatt et al, 1993). The decision to use PBS is also a responsible choice for individuals in that they are accepting responsibility for their decision to consume alcohol and are able to do something to reduce their likelihood of experiencing negative consequences and/or harming or disturbing others (Single, 1996). Prior research on the use of PBS is scarce, but what research has been conducted on the use of PBS has shown a reduction in the amount of alcohol consumed and of the negative consequences that individuals suffer from their own alcohol use (Marlatt et al., 1993, Benton et al., 2004; Delva et al., 2004). However, because this literature is scarce, more support for the use of and effectiveness of PBS is needed.

Within recent years, more attention has been given to the idea of harm reduction or harm minimization with regards to alcohol use. Researchers are gaining an understanding that with all of the attempts to reduce college student alcohol use, students are going to continue to drink and the focus should not rest solely on those frequent binge drinkers but also those moderate, social, and non-drinkers (Weitzman & Nelson, 2004). So rather than preaching abstinence, the focus should shift to providing students with skills to reduce consumption and to reduce the risk of experiencing negative consequences due to one's own or others' alcohol use. However, the ability to accurately measure the use of these harm reduction strategies (PBS) had not been established. Previous work has been conducted to develop a valid and reliable PBS scale (Benton et al, 2004; Delva et al., 2004; Martens et al., 2004), but more extensive work needs to be done. Specifically, the gender and racial differences of the underlying factor structure of

a PBS scale needs to be explored as the inherent sample differences have not been examined previously. Additionally, PBS items have not been seen as behavioral outcomes. Consequently, the correlates of enacting such PBS behaviors need to be examined. Therefore, this study will examine the dimensionality of the PBS scale and examine the relationship between the PBS and certain predictors and outcomes of interest while examining gender and racial differences in all analyses.

Specifically, this study adds to the current body of literature on PBS by examining additional strategies that can be utilized either before going out or after drinking, not just during the act of drinking or partying. Specific PBS items were created and examined in this study that do not focus solely on using alcohol which may provide more insight as to how students can stay safer when out socializing or partying. Additionally, no previous study had examined gender or ethnic differences in the scale construction of the PBS items. Another gap in the research was examining PBS as an outcome behavior rather than merely a predictor of alcohol use and related consequences. This study will clarify whether PBS is a uni-dimensional or multidimensional construct, specifically whether it has multiple PBS dimensions that relate differently to various predictors of PBS and outcomes of PBS. Therefore, the results of this study will greatly contribute to the scarce literature that exists on PBS and will further provide support for the use of PBS in evaluating Harm Reduction programs.

Summary

College student alcohol use rates remain alarmingly high, and the negative effects that students experience as a result of their alcohol use can cause numerous personal

health, academic, interpersonal, and legal problems. The use of certain PBS may reduce the amount of alcohol one consumes and/or increase the safety of how one consumes alcohol consequently leading to a decrease in the number of negative alcohol effects. However, a reliable and valid measure of PBS has yet to be created. Therefore, this study examined the dimensionality, internal consistency, and validity of a PBS scale that can be used in future research and evaluation efforts focused on reducing alcohol use and the related negative effects among college student drinkers.

Chapter 2: Review of Literature

Introduction

This chapter provides a review of the background and literature regarding: alcohol use and related problems among college students, the theoretical foundation of PBS as a construct, existing PBS measures and measurement issues, additional PBS items, approaches to determining the dimensionality of multi-item scales, approaches to determining the reliability and validity of multi-item scales, prior reliability and validity testing of PBS measures, and an overview of the variables included in the study theoretical framework for testing the validity of the PBS scale.

Alcohol Use and Related Problems among College Students

Alcohol is the most widely used drug among American youth. While much research has focused on defining and alleviating the problem of college student alcohol use, rates continue to be highest among those individuals aged 21-25 (DHHS, 2000; Ham and Hope, 2003). Binge drinking, defined as 5 drinks in a row in one sitting for males and 4 drinks for females (Wechsler et al., 1994), has also consistently been highest among those individuals aged 18-25 (DHHS, 2000). Within this demographic cohort, those students enrolled in a college or university were more likely to be current, binge, or heavy users of alcohol when compared to those individuals of the same age not enrolled in a college or university (SAMSHA, 2004; Johnston et al., 2005). The alcohol use rates have not declined in the past decade despite the nationwide university focus on this wassue.

There are many data sources that have gathered information on college student alcohol use. According to the Monitoring the Future survey that was administered in 2005 by the National Institute on Drug Abuse, about 30% of high school seniors had binged in the prior two weeks (Johnston et al., 2005). According to the National Household Survey on Drug Abuse, administered in 2004, 50% of 18-20 year olds had drunk alcohol in the prior 30 days, while 30% had binged in that time frame. Among that same age group, 13% had binged at least five times in the prior 30 days (SAMHSA, 2004).

Another source of national collegiate alcohol use data are the National College Health Assessment, which is administered by the American College Health Association. The last survey data published from the NCHA was in 2005. This data reflects self-report data from 16832 college students in public American universities. Out of 16693 students who answered the alcohol frequency item, over 66% of the respondents had used alcohol in the previous 30 days of the survey. When examining current binge drinking (within previous 2 weeks), the NCHA data indicates that over 37% of students who self-reported as drinkers had also binged at least once. Males self-reported more binge episodes when compared to females (ACHA, 2006).

One of the most current national databases of alcohol use among adolescents and young adults is the National Survey on Drug Use and Health, administered by the Substance Abuse and Mental Health Services Administration in 2005. This data are reflective of other national data. Among all individuals aged 18-20 that responded to this national survey, over 51% had reported current (within the past month) alcohol use while over 67% of individuals aged 21-25 reported current alcohol use. Binge drinking rates

were alcohol similar to rates that had been reported from other surveys. Over 36% of 18-20 and almost 46% of 21-25 year olds reported current binge drinking. According to this national data, males are more likely than females to engage in current alcohol use as well as binge and frequent binge drinking (SAMSHA, 2004).

The age of first alcohol use also remains very young despite national law that states individuals must be 21 years of age to possess or purchase alcohol (Bonnie and O'Connell, 2004). According to a Centers for Disease Control and Prevention survey (the Youth Risk Behavior Surveillance Survey, 2006), 29% of students reported consuming their first drink prior to the age of 13. The National Household Survey on Drug Abuse reported that the mean age for first use of alcohol was 15.9 years in 1999 (SAMSHA, 2004), while the data from Healthy People 2010 reported the mean age for first use to be 13.1 years of age (DHHS, 2000).

College freshmen who reside on college campuses also are in unique situations due to the transition to the college environment. First-year college students appear to be at most risk for developing alcohol-related problems due to the unique transition that students experience when enrolling in a college or university for the first time (Upcraft, 2002). Not only are most students moving out of their parents/guardians' homes for the first time, but first-year students also have to learn how to live in a residence hall with other first-year students (Upcraft, 2002). First-year college students must also have to learn how to build and maintain new social relationships, adjust to different academic standards, and learn to develop an identity, a career, a lifestyle, and philosophy of life (Upcraft, 2002) all while trying to stay as healthy as possible. The transition to college may be problematic due to all of these factors and may lead to students using alcohol to

adjust, fit in, and deal with the various stressors. Therefore, incoming college students should be armed with such protective strategies so that if they choose to drink, they can drink more responsibly.

While alcohol use rates continue to remain elevated, what may be more alarming is the multitude of negative consequences that adolescents and young adults suffer as a result of consuming alcohol. Negative consequences associated with alcohol use among college students had been categorized into health, personal, academic, legal, and financial problems. Health consequences include motor vehicle accidents, risky sexual behaviors, increased risk for other drug use, increased mental health problems, unintentional injuries, homicide, and suicide. Personal problems include fights with friends or family and other relationship problems. Legal issues include arrests or citations as a result of alcohol use. Negative academic consequences associated with alcohol use include being late or missing class, being late or neglecting to turn in assignments, failing exams, being placed on academic probation, and being kicked out of school (Griffin, Scheier, Botvin, & Diaz, 2000; Wechsler, Lee, Nelson & Kuo, 2002; Perkins, 2002; Reis, Trockel, & Wall, 2003; Park, 2004).

National data has shone the light on just how prevalent these negative consequences are among young people. The NHSDA data (SAMSHA, 2004) indicate that 27% of young adults drove under the influence within the previous 12 months with the NCHA data reflecting that percentage (ACHA, 2006). These statistics are undeniably a factor in the multitude of traffic accidents and motor vehicle deaths that claim young lives. It has been reported that over 1700 college students die from alcohol-related injuries (including motor vehicle accidents) (Hingson et al., 2005). According to the

College Alcohol Study, personal alcohol use resulted in about 35% of students getting into fights or verbal altercations, 30% of students missing class, 27% reported blacking out or suffering memory loss, and 23% reporting poor test performance as a result of alcohol use. Other consequences among college students were that 13% reported being hit or assaulted, 12% being injured, and 8% having unprotected sexual intercourse (CAS). The NCHA data reflect that of the CAS data with about 27% of respondents reporting that they had done something they regretted, 22% forgetting where they were or what they did, 13% being physically injured, and 12% having unprotected sex (ACHA, 2006). According to Hingson, Heeren, Zakocs, Kostein, and Wechsler (2002), over 400,000 students had unprotected intercourse as a result of alcohol use. More alarming is that almost 100,000 students are the victims of date rape or sexual assault every year which may not factor in the over 100,000 students reported being too intoxicated to know if they even had intercourse the previous night (Hingson, Heeren, Zakocs, Kostein, & Wechsler, 2002; Hingson, Heeren, Winter, & Wechsler, 2005).

The Core Alcohol & Drug Survey has also examined the negative consequences associated with alcohol use (Perkins, 2002). The most common consequences were nausea or vomiting (56%), hangover (47%), blackout or memory loss (31%), missed class or poor academic performance (28%), and personal injury (15%). Among a smaller study of 263 undergraduates at a public American University, the most commonly reported negative consequence was suffering a hangover with 33% of females and 28% of males reporting this effect. Gender and ethnic rates of consequences mirror that of general alcohol use with males and White students experiencing more negative effects from personal alcohol use. This trend has been reported to increase during the transition

from high school to college and then decreasing as individuals graduate from college and get older. Negative consequences seem to be more prevalent among frequent binge drinkers (Perkins, 2002). It was obvious that a majority of college students will experience a negative effect from their drinking during their college careers. While these negative effects may seem trivial (such as having a headache), they can lead to a decreased quality of life, trouble in school and life, and long-term health effects.

Because of the multitude of negative personal effects students experience as a result of their alcohol use, a better understanding of strategies to reduce those effects is needed. The use of PBS has been hypothesized to reduce the negative effects experienced among drinkers. However, because the construct validity of the PBS scale is in question, a need to examine the relationship between the PBS sub-scales and negative effects is needed to better understand which PBS sub-scales are most effective in reducing negative effects.

Theoretical Foundation of PBS as a Construct

Protective behavioral strategies (PBS) are those self-control behaviors individuals practice prior to, during, and/or after drinking to either limit consumption or to limit negative consequences associated with alcohol use. The term 'protective behavioral strategies' first garnered attention when various authors (Benton et al., 2004; Delva et al. et al., 2004; Martens et al., 2004) began to research this construct and its relationship with negative alcohol effects. However, Werch (1990) used the term self-control strategies to examine the same type of risk reduction behaviors. Even though harm reduction programs had been implemented in the past 10-15 years, these PBS have since

gained much more recent national attention in an attempt to understand college student alcohol use and has been a fixture in the National College Health Assessment conducted by the American College Health Association (2006) for the past few years.

The Harm Reduction model is a secondary prevention ideal that posits that with the use of certain strategies that can include environmental, community, interpersonal or personal strategies, a person can reduce their experiences of negative consequences because of certain decisions or behaviors in which they engage (Marlatt et al., 1993; Single, 1996; Marlatt & Witkiewitz, 2002; McBride et al., 2003; Graham, Tatterson, Roberts, & Johnston., 2004). Health behavior consequences can be placed on a continuum of more serious and less serious consequences which coincides with substance use ranging from excessive use, moderation, and abstinence. Alcohol consumption and the negative consequences that result from personal alcohol use are applicable to this continuum (Marlatt et al., 1993). However, alcohol use was not typically seen as a problem, even though some are underage, until negative consequences result from consuming alcohol. Responsible drinking can result in no negative effects even though students are still partaking in an 'unacceptable' behavior. The negative consequences associated with alcohol use can range from being late to class to throwing up to being taken to the emergency room due to alcohol poisoning that can lead to death. The severity of such consequences varies from individual to individual and some people are willing to deal with minor consequences. The Harm Reduction model posits that among drinkers, certain strategies can reduce the likelihood of experiencing serious negative consequences. These strategies can be personal, such as limiting the amount of alcohol consumed or only drinking a certain type of alcohol (Marlatt and Witkiewitz, 2002;

Delva et al., 2004; Benton et al., 2004). These strategies can also be environmental or community strategies that include serving liquor in plastic containers only, server training programs, or the provision of free public transportation from bars and other public drinking establishments (Single, 1996). By providing students with the skills to minimize harm while still consuming alcohol, students should become empowered and confident in their ability to make healthy decisions. Thus, these empowering skills should be provided to students at a young age so alcohol use was not a problem that persists into adulthood.

The foundation of harm reduction is consistent with the literature on PBS (Marlatt & Witkiewitz, 2002). If students know they are going out to drink, there are strategies they can employ, albeit while still consuming alcohol, that will help them to limit their consumption and consequently the negative effects that may occur from consuming too much alcohol. Marlatt et al. (1993) suggests that any movement along the continuum towards abstinence is a measure of success even if abstinence is never attained since a reduction in use can minimize the consequences associated with the substance. It was also important to reach the student at their current level of drinking and stress minor improvements in their alcohol use. Thus, moderate drinking can significantly improve one's quality of life even though one is still engaging in alcohol consumption (Marlatt et al., 1993).

Harm reduction can also be seen as a bottom up approach that empowers students to make good decisions and recognizes that abstinence does not have to be the ultimate goal (Marlatt, 1996). A bottom up approach refers to a method that allows students to make their own decisions based upon their own attitudes, beliefs, and behaviors rather

than just following 'rules' or policies set forth by administrators (Marlatt, 1996). The use of harm reduction approaches to decreasing problems associated with alcohol use has a high likelihood of success given that this approach has been successful in reducing problems with other risky health behaviors such as sexual behaviors, gambling, and illicit drug use and because it allows students to make decisions that best work within their lifestyles.

Harm reduction approaches had been utilized to address risks associated with sexual behavior for the past few decades. For example, alternatives to sexual abstinence as a way of reducing the risk of unwanted pregnancy and sexually transmitted infections while still allowing sexual intimacy include 'safer sex' practices which can include mutual masturbation, heavy petting, and oral sex. Additionally, various forms of contraception are now available either over the counter or with a prescription to reduce the risk of unwanted pregnancy. HIV/AIDS harm reduction programs had been successful in increasing adolescents' use of contraception and safer sex methods (Fisher, Fisher, Misovich, Kimble, & Malloy, 1996), while condom distribution and needle exchange programs (beginning in the 1980's) have also been successful in reducing the risk of HIV transmission in sex workers and intravenous drug users (Duncan, Hawkins, Petosa, Nicholson, & Clifford, 1994; Bonomo & Bowes, 2001; Castro & Foy, 2002; Sharp, 2005).

With regards to substance use, harm reduction methods also promote incremental or continuum changes toward improved health behaviors rather than requiring the substance user to quit 'cold turkey'. For example, crystal methamphetamine injectors (who are not yet addicted) who can cease injecting and smoke the substance instead can

greatly reduce their risk of experiencing severe negative consequences of their behavior (Sharp, 2005). Another successful example of harm reduction with drug users is onsite ecstasy drug testing for club goers. These programs involve substance testing of individual ecstasy pills at raves and other clubs to assess the composition of each pill while also providing information about drinking water and signs of drug overdose to club goers (Castro & Foy, 2002). This testing of individual pills is critical because the composition of illicit drugs was not regulated and can therefore contain many other harmful substances unbeknownst to the user which can cause serious adverse reactions (Castro & Foy, 2002). Thus, these programs do not stress abstinence but aim to make the use safer to the users do not suffer serious negative effects.

Youth gambling is another increasing health concern which has been positively addressed with harm reduction approaches (Dickson, Derevensky, & Gupta, 2004). Gambling is similar to alcohol use in that the negative consequences can be placed upon a continuum of harm ranging from full-blown addiction or bankruptcy to more minor consequences such as occasionally neglecting work or school or interpersonal problems. The goal of harm reduction for social gamblers specifically is to focus on the provision of coping skills, resilience techniques, decision-making skills, knowledge about the effects of gambling, delaying the onset of gambling, as well as self-controlling behaviors (Dickson et al., 2004).

The success of harm reduction approaches with risky health behaviors and the likelihood of adolescents experimenting with substances (especially alcohol) provides evidence that harm reduction programs are needed, especially for those adolescents who

have begun to experiment or may be dependent on drugs (Becker, Agopian, & Yeh, 1992; Ennett, Flewelling, Tobler, & Ringwalt, 1994; Bonomo & Bowes, 2001).

Existing PBS Measures and Measurement Issues

There are three scales that had been used in prior research that focuses on these individually based behavioral skills. One 10-item scale is part of the Campus Alcohol Survey used by Benton et al. (2004). The response options on the CAS were never, rarely, sometimes, usually, and always. Those items found in the CAS are

- Stopped drinking at least 1-2 hours before going home
- Alternating with nonalcoholic beverages
- Having a designated driver
- Limiting the number of drinks
- Making one's own drinks
- Limiting money spent on alcohol
- Only drinking in safe environments
- Hanging out with trusted friends
- Counting drinking
- Pacing the number of drinks per hour

Using the CAS (Campus Alcohol Survey) data, Benton et al. (2004) examined the moderating effects of PBS on drinking levels and negative consequences. Benton et al. (2004) summed all 10 items into a single variable. The results of Benton et al.'s analyses indicate that women use PBS more frequently than males. Hierarchical analysis using gender, number of drinks, and PBS as the predictor variables indicated that those

individuals who drink to excess but use PBS experience less consequences than those who drink to excess and do not utilize PBS (Benton et al., 2004).

Another set of items also contained 10 items with few differences found in the National College Health Assessment utilized by the American College Heath Association (Delva et al., 2004) The items found in the NCHA (ACHA, 2005) include

- Alternate non-alcoholic with alcohol beverages
- Determine, in advance, not to exceed a set number of drinks
- Choose not to drink alcohol
- Use a designated driver
- Eat before and/or during drinking
- Have a friend let you know when you've had too enough
- Keep track of how many drinks you were having
- Pace your drinks to 1 or fewer per hour
- Avoid drinking games
- Drink an alcohol look-alike (non-alcoholic beer, punch, etc)

The coded response options for the items on the NCHA were 5=always, 4=usually, 3=sometimes, 2=rarely, and 1=never. Because the authors wanted to limit the strategies to those that students actually use when drinking, they dropped 2 items (choose not to drink alcohol and drink and alcohol look-alike) and summed the remaining 8 items. Those items had good internal consistency with a Cronbach's alpha of .76. No data were reported on validity testing of these items (Delva et al., 2004). Delva et al. also ranked the PBS into 4 quartiles based on summative scores.

Utilizing the data gathered from the National College Health Assessment among 1043 self-reported drinkers, Delva et al. (2004) examined students' use of PBS and its relationship with negative consequences. Delva et al. identified the number, type, and frequency of use of PBS among 1043 college students who disclosed recent drinking behavior. The most commonly used PBS were using a designated driver (74.6% female, 63.9% male), eaten before or during drinking (74.3% female, 70.7% male), and keeping track of the number of drinks (65.4% female, 55.8% male). Results from the multivariate analysis indicated that an increase in use of PBS resulted in a significant reduction in the experience of negative consequences due to personal alcohol use (Delva et al., 2004).

Martens et al. (2004) also used the NCHA data to examine the moderating effect of PBS on negative consequences. This analysis was based on self-reported data gathered from 556 undergraduates. Martens et al. (2004) also only utilized 8 items (dropping 2 items pertaining to not using alcohol). The authors summed all 8 items and utilized a hierarchical logistic regression to determine the relationship between use of PBS and experiencing negative effects. The results were similar to that found by Benton et al. (2004) in that those students who disclosed recent drinking behaviors were less likely to suffer negative consequences if they had used PBS.

Werch (1990) may have been one of the first researchers to focus on what he termed "self-control strategies (SCS)". His research on the relationship between use of these SCS and alcohol use and negative consequences was conducted almost twenty years ago. His results were based on self-reported survey data from 456 college students. However, students were instructed to respond to the specific SCS based on how often they used the strategies to deliberately limit their drinking. Thus, Werch (1990) may

have not been able to identify effective strategies students utilized before, but especially, after drinking to protect themselves from negative effects resulting from their own alcohol use. The response options ranged from never to always. Originally 37 self-control strategies were tested, but Werch only included fourteen; he chose the two highest loading items on seven factors that resulted from a factor analysis even though the original 37 items had high test-retest reliability (r=.96). Werch then classified the seven factors as rate control (select drinks I drink slowly, set time limits before another), self-reinforcement and punishment (reward myself for limiting, punish myself for not limiting), alternatives (alternatives substitute other means for a "high", substitute other means for socializing), avoidance (avoid drinking with heavy drinkers, avoid drinking with those pressuring), limiting driving and cash (drink less when driving, don't drive when drinking), controlling time and food (eat before drinking, confine drinking to certain times), and awareness (refuse unwanted drinks, use body sensations to slow down) (Werch, 1990).

Werch's (1990) findings are similar to the findings of the more current research in that use of self-control strategies were effective in limiting quantity of alcohol when drinking and reducing the number of negative consequences students experience as a result of their own alcohol use. Werch found that females use more SCS than males. However, males were more likely to substitute other means for achieving a "high". Werch also classified those strategies that are most effective for reducing certain alcohol use behaviors. Substituting other means of socializing was effective to reduce frequency of alcohol use. Avoiding drinking with those who pressure, confining drinking to certain times of the week, and refusing unwanted drinks were successful strategies shown to

reduce the quantity of alcohol use. Confining drinking to certain times during the week, refusing unwanted drinks, and setting time limits on drinking were effective in reducing negative consequences related to personal alcohol use (Werch, 1990). Werch's finding suggest that college students do engage in specific protective behaviors when drinking alcohol, thus providing additional support for the provision of such strategies to all students. Werch's (1990) findings are still critical today in the research on why college students drink and what skills students can use to reduce their risk of problems associated with drinking.

Additional PBS Items

The remaining seven items which were created by the parent research project, Peers as Family (PAF) (explained in depth in Chapter 3), during an in-depth formative research period (Howard et al., 2007). To gain a better understanding of the impact alcohol has on current freshmen students, eight focus groups were planned and conducted with 47 first-year freshmen residing in the targeted residence halls. The focus group moderator guide was developed through an intensive process by identifying all possible questions and topics that were important in understanding the role of alcohol on college campuses. Members of the developmental workgroup included individuals from the university's health center, Department of Student Affairs, Department of Resident Life, and the Department of Public and Community Health. Numerous meetings were held and the original list of questions was reduced to a set of eight sections of items including social life, problem drinking, protection, helping, and needs for an alcohol intervention.

First-time freshmen students not residing in the study wings were invited to participate in the hour and a half long focus group discussions. The students were recruited with emails and flyers and were asked to sign up for a convenient date and time on a web-site created specifically for this study. Once an adequate number of students had signed up, a staff member then assigned students to a female-only, a male-only, or a mixed-gender focus group. The assignments were done so as to assure ethnic diversity and so that no two students from a single wing were at any one focus group.

Of particular interest to the use of PBS, students were specifically asked "What do students do to stay safe when they are going out to drink?" among other questions. All discussions were recorded. Once all focus groups had been conducted, each discussion's recording was transcribed verbatim. The transcripts were then reviewed by two neutral staff members to assure reliability of the focus group information.

The transcribed data were then analyzed with ATLAS.ti, a computerized qualitative analysis program. Data were coded by themes, and each theme was then examined to identify a common meaning (Howard et al., 2007). After extensive analysis of the focus group data using a sophisticated phenomenological approach, specific protective strategies were identified by students. These strategies included behaviors exhibited before, during, and after alcohol consumption. Those strategies of particular importance were those that differed from previously identified protective strategies utilized in previous survey studies. Those seven items which differed from prior PBS items identified in previous research and which were subsequently included in the PAF survey included the following items. These items are of additional interest due to their disclosure by college students themselves.

- “avoid hard liquor or spirits”
- “refuse a drink from a stranger”
- “never leave your drink unattended”
- “carry around a cup but not drink any alcohol”
- “use public transportation services”
- “avoid situations where there was alcohol”
- “participate in activities that did not include alcohol”.

An illustration of all PBS or related items that had been utilized in recent studies is included in Table 1 below.

Table 2.1. Illustration of Existing and New PBS Items

PBS Item	PAF, 2005	Delva, 2004; Martens, 2004	Benton et al., 2004	Martens et al., 2005**	Werch et al., 1990
Alternate non-alcoholic beverages and alcoholic beverages	x	x	x	xx	
Determine, in advance, not to exceed a set number of drinks	x	x	x	x	
Eat before and/or during drinking	x	x			x
Have a friend let you know you'd had enough	x	x		x	
Keep track of how many drinks you were having	x	x	x		
Pace your drinks to 1 or fewer per hour	x	x	x	x	xx
Avoid drinking games	x	x		xx	x
Stop drinking at least 1-2 hours before going home	x		x	x	
Limit money spent on alcohol	x		x		
Only drink in safe environments	x		x		
Make your own drinks	x		x		
Avoid hard liquor or spirits	x			xx	
Refuse a drink from a stranger	x				x
Never leave your drink unattended	x			x	
Choose not to drink alcohol	x	x			
Use a designated driver	x	x	x	x	x
Drink an alcohol look-alike (non-alcoholic beer, etc)	x	x			
Hang out with trusted friends	x		x	x	
Participate in activities that did not include alcohol	x				xx
^^Carry around a cup but not drink any alcohol	x				
^^Use public transportation services	x				
^^Avoid situations where there was alcohol	x				
Reward myself for limiting					x
Punish myself for not limiting					x
Drink less when driving					x
Confine drinking to certain times					x
Use body sensations to slow down					x
Leave the bar/party at a predetermined time				x	
Put extra ice in your drink				x	

^^Unique contribution of PAF survey items.

**These items not available at time of original survey creation.

Approaches to Determining the Dimensionality of Multi-Item Scales

Structural validity is a process by which the potential scale items are put through a specific analysis to determine how well certain scale items fit together and how well the internal structure of the items reflect the overall concept to be measured. Factor analysis is a common technique that can assess structural validity (Kachigan, 1991; Nunnally & Bernstein, 1994; Clark & Watson, 1995; DeVellis, 2003) and determine the dimensionality of a set of scale items. Another common technique utilized during the assessment of structural validity is internal consistency which includes an analysis of the inter-item correlations and item to total correlations. An in-depth look at both the factor analysis and internal consistency of scale items can provide critical information into the overall scale. However, these two tools should not be used individually and should not be seen as the end-all in scale development (Clark & Watson, 1995). It was noted that dimensionality and reliability analysis was considered when creating the final PBS scale.

Factor analysis is a "well-defined procedure for identifying and extracting the redundancy within the correlation matrix" (Kachigan.1991). By doing so, it takes out the subjectivity of the researcher to group items based on how one thinks they should be grouped and relies solely on the responses to each specific item. Factor analysis is to be utilized to identify underlying factors within a large group of items or to determine which variables should be included in subsequent multivariate analyses (Kachigan, 1991; Nunnally & Bernstein, 1994; Clark & Watson, 1995; DeVellis, 2003). Factor analysis is a technique used to "remove the redundancy from a set of 'derived' variables, or factors". Thus, factor analysis reduces the number of items into related groups and highly correlated items are clustered together into the factors (Kachigan.1991). One of the most

important goals of this study was to identify and realize the underlying factor structure of the pool of PBS. Thus, factor analysis was the primary statistical tool used to further develop the PBS scale.

However, factor analysis cannot be used to directly compare different groups of students. According to Ommundsen, Morch, Hak, Larsen, and Veer (2002), factors could have different interpretations for different samples. A meaningful comparison cannot be made until the factors from the different samples until the factors are rotated, translated, stretched and shrunken to a target matrix until maximal agreement is obtained between the factor solutions. Therefore, there is a need to examine the cross-stability of the factors. One method by which this examination of cross-stability can be achieved is with orthogonal procrustes rotation. Procrustes rotation is a "least-sqaures problem of transforming a given matrix A into a given matrix B by an orthogonal transformation matrix T so that the sums of squares of the residual matrix E = AT-B is a minimum" (Schönemann, 1966). This technique 'stretches' and 'shrinks' the factors from the different samples to obtain the 'best fit' or maximum likelihood of fit (Gorsuch, 1983) so that the samples can be directly compared with each other. Specifically stated, the procrustes method will rotate the factors from males and the factors from females onto each other. The factors will then be manipulated until the best fit was obtained which represents both samples as well as possible (Gorsuch, 1983). Two matrices are produced via procrustes rotation: a matrix of best fit and a residual matrix representing lact of fit among the factors (and individual variables) (Gorsuch, 1983).

The residual matrix is a matrix of coefficients representing variance not accounted for by the first factor, or the "influence of the first factor is removed and then the

correlations of the first defining variable with all other variables are zero in the uncorrelated component approach" (Gorsuch, 1983; page 77). In addition to the residual matrix, the coefficient of non-determination is also produced. The coefficient of non-determination is similar to the coefficient of determination (R^2). The coefficient of non-determination can be obtained by subtract R^2 from 1 and can be used to explain the proportion of variance not explained by the rotated factors (Hair, 1998). While the coefficient of non-determination is a useful statistic to utilize and can help gain a better understanding of the factor fit for different samples, there is no consensus of what constitutes a 'good' or 'bad' coefficient of non-determination. However, an R^2 value over .80 is considered really high, so a coefficient of non-determination of less than .20 should be acceptable with a number approaching .00 is ideal.

Approaches to Determining the Reliability and Validity of Multi-Item Scales

As mentioned previously, measures of internal consistency (or reliability) can add support and justification for a final scale. Internal consistency refers to "the overall degree to which the items that make up a scale are inter-correlated" (Clark & Watson, 1995) or the homogeneity of scale items and how well all items correlate with all other items (DeVellis, 2003). The coefficient alpha that is commonly reported to represent internal consistency is the Cronbach's coefficient alpha. The alpha that is produced from the matrix represents the proportion of the "scale's total variance that is attributable to a common source, presumably the true score of a latent variable underlying the items" (DeVellis, 2003). Alpha could also be described as the "communal portion of total variance in a scale that can be attributed to the items' common source" (DeVellis, 2003).

Test-retest reliability is another form of internal consistency analysis that provides support to the stability of reliability over time and with the same group of participants (Trochim, 2001). Test-retest reliability has been defined as the correlation between successive measurements on a set of objects with respect to a variable (Kachigan, 1991) and can be examined by running Pearson product-moment correlation coefficients between the two administrations of the measure. While test-retest reliability is a common method to further assess internal consistency, it was not without limitations. Important limitations and assumptions to consider when utilizing test-retest reliability include the possibility of inflated reliability estimates as well as inherent response bias from participants if the test-retest period is too short and participants can remember their previous responses. An additional assumption is that survey respondents understand each item and responds honestly (Di Iorio, 2005).

Within behavioral research, it was recommended that an alpha level of at least .80 be retained for a group of items; however, an alpha level of .70 is also deemed acceptable (DeVellis, 2003, Di Iorio, 2005). It was important to remember, however, that internal consistency alone can not be the determining factor in the dimensionality and construction of the final scale. Rather, the dimensionality, reliability, and interpretability will all be examined when creating the final PBS scale.

One underlying component of scale development is validity. Validity can be described as how well a set of items represents an underlying concept. Whereas a set of items can be very reliable and correlated, a set of reliable items may or may not accurately represent a general concept. The main type of validity that was focused upon in this study is convergent validity.

Construct validity is "directly concerned with the theoretical relationship of a variable to other variables" (DeVellis, 2003). This form of validity pertains to the scale's ability to interact with the outcome of interest as it was theoretically meant to interact. In other words, does the scale measure what is it supposed to measure? Construct validity can also be categorized as substantive, structural, and external whereas substantive and structural validity together can be used as a measure of internal validity. Substantive validity refers to the initial pool of questions and how well they relate to the concept one is trying to measure. By specifically defining what the concept is that needs to be measured can set one on the right path to creating a valid scale measure (Clark & Watson, 1995). The inclusion of the specific PBS items that are included in this study was based on a literature review to identify what research has already been conducted and focus group discussions with college students. It has been explained previously the issues that arise in terms of the construct validity of the PBS scale, thus providing rationale for this study. It was important to note that when discussing convergent and discriminant validitiy, no standard definition is available. Various authors (Nunnally & Bernstein, 1994; Clark & Watson, 1995; Hair et al., 1998; Trochim, 2001; Di Iorio, 2005) have all defined these terms differently. Therefore, when defining and explaining the methodology by which to assess these types of validity, it was important to note that even though different definitions, the basic methodology by which to assess convergent and discriminant validity is similar.

Convergent validity has been defined as "the operationalization's ability to distinguish between groups it should theoretically be able to distinguish between" (Trochim, 2001). Discriminant validity has been defined as "the degree to which the

operationalization's was not similar to other operationalizations that it theoretically should be not similar to" (Trochim, 2001). Convergent and discriminant validity are closely related such that by providing evidence that an operationalization is related to other operationalizations you support convergent validity while not supporting discriminant validity. These two steps are critical in establishing a scale because the new scale should not be redundant of existing measures but should be able to measure what it theoretically should measure (Nunnally & Bernstein, 1994). Both types of validity ultimately provide support for the overall construct validity of a measure and thus, both types of validity (convergent and discriminant) was examined to further provide support for the PBS scale.

Prior Reliability and Validity Testing of PBS Measure

When compiling the newly created PBS items based on formative research with those 15 items that were found in existing literature, the construct validity of this 'scale' was suspect. The items seemed to cluster is distinct and specific ways. However, further examination of the NCHA-specific PBS resulted in no formative research having been conducted to examine the face validity or construct validity of the initial ten protective strategies included in the instrument (Leino, ACHA per email, 2007). No information was available to indicate how those specific ten items ended up in the instrument. The lack of preliminary research on the inclusion of PBS is discouraging, therefore reliability and validity testing must be conducted to validate these items and provide further support for its inclusion in alcohol research (Delva et al., 2004).

Further examination of the validity testing conducted by Benton et al. (2004) revealed interesting outcomes. No information was reported on the formative research that led to the creation of the ten items that were included in the Campus Alcohol Survey. Additionally, no research was conducted or presented on the initial construct and face validity and internal consistency of those items. However, Benton et al. conducted validity and reliability tests on their sample. Principal components analysis was conducted and resulted in two factors from the initial ten items. The first factor explained 36.44% of the variance and included 5 items. The items in this factor had moderate correlations ($r > .51$) and an overall reliability score of .80. The second factor explained 11.64% of the variance and included the remaining 5 items. The correlations among these five items were low ($r > .29$) and also had a below acceptable reliability score of .65. Even though the results indicate a 2-factor solution, the authors chose to include all items in a single factor without justification. The combined items had a Cronbach's alpha of .95 and produced strong correlations with the lowest being .67 (Benton et al., 2004).

More recently, Glassman, Werch, and Jobli (2007) have factor analyzed 13 of the self-control strategies from data collected in 2002 from a random sample of high school students. While those strategies were aimed at a younger set of adolescents and focused on staying away from alcohol (not reducing consumption), they still lend support for the use of protective strategies. The authors used VARIMAX rotation, assessed the Scree plot, and only included factor loadings of at least .500 (Glassman et al., 2007). The three sub-scales that emerged from the analysis were Health Alternatives ($\alpha = .81$), Self-regulation ($\alpha = .72$), and Assertive Communication ($\alpha = .73$). All three of the sub-scales

were shown to be significantly related to alcohol use frequency and quantity as well as alcohol-related consequences (Glassman et al., 2007).

Because of the lack of testing that has been conducted on the PBS scale and because of its' obvious importance in the research of alcohol use, Martens et al. (2005) have recently examined a PBS scale. As part of that development, additional items were created. The researchers studied existing literature for strategies that have previously been shown effective in reducing alcohol use and discussed such strategies with students. Based on their formative research, a pool of items was created/modified that reflected strategies that students could use before or during their drinking episode. The authors then had six graduate students review the items and provide input. Twenty-five items were included in the initial PBS survey. The response options ranged from never to always (Martens et al., 2005).

The survey was administered to 528 students who volunteered to participate in the survey. Once data had been collected, the authors decided to only analyze data on self-reported drinkers. The final sample consisted of 437 students, including a majority of white females. The data on the 25 PBS items was screened for univariate normality. One item was removed because of a positive skew (Martens et al., 2005).

The remaining items were put through an exploratory factor analysis. Nine items were deleted because of low communalities, low factor loadings and/or strong loadings on more than one factor. The authors then conducted a final exploratory factor analysis on the remaining 15 items. The analysis resulted in three factors which accounted for 52% of the variance. The authors named the three factors Limiting/Stopping Drinking (7 items), Manner of Drinking (5 items), and Serious Harm Reduction (3 items). The

Cronbach's alpha coefficients for the three factors were .81, .73, and .63, respectively. The authors also determined that the three factors had acceptable convergent validity while still upholding their distinctness. The authors then conducted hierarchical multiple regression to test the predictive ability of the sub-scales on alcohol use and negative consequences. The Manner of Drinking items had the best predictive ability on all outcome variables. The Harm Reduction sub-scale predicted consequences and number of drinking days, while the Limiting/Stopping Drinking sub-scale was only related to the number of drinks in a sitting (Martens et al., 2005). However, Martens et al. (2005) identified that the PBS needs to undergo more psychometric analysis to provide support for the inclusion of these items in future research. Additionally, the PBS needs to further be proven as a reliable and valid measure in preventing alcohol use and alcohol-related consequences.

Study Conceptual Framework for Testing the Validity of the PBS Scale

Prior research has examined the relationship between PBS and alcohol use and negative alcohol effects (Benton et al., 2004; Denton et al., 2004; Martens et al., 2004). However, the PBS measure has not been examined as a behavioral outcome when, in fact, each of the strategies is a behavior in and of itself. Therefore, it was critical to understand what factors lead to college student drinkers actually engaging in such protective behaviors. Common themes that arise when examining the history of alcohol use behaviors are expectations and self-efficacy. Expectations are included in the Theory of Reasoned Action (TRA) as a construct predicting one's attitudes of a specific behavior (Fishbein & Ajzen, 1972). Expectations are thought to predict (alcohol use) behaviors

because it was hypothesized that the anticipated outcomes of performing a specific behavior (alcohol use in this study) play a significant role in whether the behavior was performed (Fishbein & Ajzen, 1972; Fromme, Stroot & Kaplan, 1993; Kuther & Higgins, 2003; Fromme and Corbin, 2004). More specifically, if a student expects good things to happen because of drinking alcohol, s/he was more inclined to drink alcohol. Conversely, if a student expects good things to happen if s/he does not drink alcohol, s/he may be more inclined to not drink alcohol.

Self-efficacy is an important variable in all behavioral research because it was thought that one must possess a certain level of confidence in performing a behavior prior to actually performing a behavior (Bandura, 1986). Since expectations and self-efficacy are important concepts to consider when researching alcohol use among college students, the relationships between each of the concepts and PBS were examined.

Alcohol Abstinence Expectations

To gain a better understanding of harm reduction research, it was important to comprehend what college students achieve by consuming alcohol. Even though there is a multitude of negative effects that can result from consuming alcohol, there are also positive effects of drinking. If a person thinks good things will result from drinking alcohol, they are more likely to consume. Conversely, if a person thinks bad things will happen after consuming alcohol, they are less likely to engage. The positive effects that result from alcohol use include improved social facilitation, ease of talking to others, feeling of being part of a group, tension relief, performance enhancement, activity enhancement, (Park, 2004). The most common positive effects are having fun or social

facilitation, improved ability to express oneself, ability to meet new friends, and easier to have sexual intercourse with someone (Park, 2004).

These positive effects may act as reinforcements to encourage future alcohol use, especially if they outweigh the negative effects alcohol has on a person. If a student can feel more comfortable in social situations and has positive expectations of alcohol, this could be a strong motivational factor for students to drink. Thus, a student should be armed with PBS so that if they do indeed make the decision to drink, they can do so responsibly and in a way to decrease their likelihood of experiencing the negative effects of alcohol while still experiencing those positive outcomes. Obviously, this was a delicate balance because of the legality of drinking, but students should be armed with the skills to make responsible decisions regarding alcohol and still be able to socialize in a manner common among college students.

While it was important to understand what students expect from drinking, an interesting concept is what students expect from abstaining from alcohol in social situations. In the related intervention in which the data for this study was gathered, a need to understand what students expected by remaining alcohol free existed. Thus, the abstinence expectation items were created and were used to examine the relationship between these expectations and the use of PBS as well as the outcomes of interest. Because these expectations are specific to students perceptions of how they would act if they abstained from drinking alcohol, it was thought that these expectations was related to the hypothesized alcohol avoidance PBS sub-scale since those specific strategies are related to not drinking alcohol. This expected relationship is based on the ideal that if

students expect positive results from not drinking alcohol, they was more likely to not drink alcohol and still achieve positive results.

Self-Efficacy

Self-efficacy can be defined as the confidence a person has in their ability to perform a specific action or task. Self-efficacy is a crucial construct in successful health behavior theories such as the Health Belief Model (Rosenstock, Stretcher, & Becker, 1988) and the Social Cognitive Theory (Bandura, 1986). Bandura (1986) posits that self-efficacy is the most important personal factor in behavior change. Therefore, this study must examine the relationship between students' self-efficacy and their use of PBS.

The role of self-efficacy in alcohol research has often been limited to drinking refusal self-efficacy (Oei et al., 2005). However, this context of self-efficacy is limited to those students who choose not to drink rather than assessing students' confidence in drinking more responsibly. Refusal self-efficacy has been shown to predict alcohol use (Engels, Weirs, Lemmers, & Overbeek, 2005) and those with lower overall drinking self-efficacy may be more likely to engage in high-risk drinking (Blume, Schmaling, & Marlatt, 2003). More alarming is that those students with low self-efficacy for avoiding heavy drinking and held positive expectancies of alcohol were more likely to drink heavier that those even with low self-efficacy but negative expectancies (Gilles, Turk, & Fresco, 2006).

Because this study is focusing on protective behavioral strategies that include skills to abstain from alcohol as well as drinking more responsibly, self-efficacy is an important construct to include in the theoretical framework of this study. Because

drinking refusal self-efficacy and self-efficacy for avoiding heavy drinking has been shown to be predictive of alcohol use, further self-efficacy contexts need to be examined in relation to PBS to understand what constructs may predict students' use of different PBS. Those contexts include general alcohol protection self-efficacy and items specific to avoiding drinking to the point of getting drunk (drunkenness avoidance self-efficacy). These items that were created by the PAF research staff are explained in further detail in chapter 3.

It was hypothesized that drinking refusal self-efficacy was related to the alcohol avoidance PBS sub-scale, protection self-efficacy was related to all three hypothesized PBS sub-scales (alcohol avoidance, drinking responsibly, safe environments), and drunkenness avoidance self-efficacy was related to the drinking responsibly PBS sub-scale. Drinking refusal self-efficacy is thought to be related to alcohol avoidance because both concepts relate to the students' not drinking alcohol of any type in any situation. Protection self-efficacy is thought to relate to all hypothesized sub-scales because these specific efficacy items focus not only the situational aspect of drinking alcohol but also the ability to reduce or abstain from drinking. The drinking refusal self-efficacy items were related specifically to limiting the amount of alcohol one consume and, therefore, would be expected to relate to PBS items that focus on drinking alcohol (not abstaining) but in a more responsible and safe manner.

Potential Confounders

Important potential confounders in this study include gender and race/ethnicity. These confounders were examined by including group-specific factor analyses and

psychometric testing in addition to total sample analyses. By examining the differences between gender and race in the scale construction and interpretability, gaps in the current literature on PBS were narrowed. Furthermore, because of the parent study's aims, study condition and living-learning membership were controlled for. Student in the parent study's sample were assigned to the single-gender, mixed-gender, or control condition. Those in the single and mixed gender were recruited to participate in a series of study educational workshops. Participation in these workshops may have resulted in changes in students' use of PBS, use of alcohol, and experiences of negative alcohol-related effects. More information about the parent study is included in Chapter 3. Living-learning membership is a potential confounder because of the characteristics of the living-learning programs. These programs are university-sponsored academic programs in which students must apply and be accepted into a special-group learning program. Students in these programs not only study together but also reside together in on-campus dormitories. Because of the academic rigor and goals of these programs, students belonging to such programs may be different than those not belonging to such living-learning programs. Therefore, living-learning memberships (as well as study condition, gender and race) were controlled for when examining the validity of the PBS sub-scales.

Summary

It was evident that alcohol consumption remains problematic among college students. While stark gender and ethnic differences exist regarding use and effects, scarce research is available to identify the gender and ethnic differences in the use of PBS. Furthermore, it was not understood if gender or ethnic differences exist when

examining the relationship between PBS and alcohol use and negative effects. The rates at which students utilize alcohol have consequently resulted in numerous and a variety of negative personal affects. Therefore, strategies to reduce alcohol use and the related effects must be explored and developed. PBS are those self-control behaviors individuals practice prior to or during drinking to either limit consumption or the negative consequences associated with alcohol use. In addition to the scarce literature on the gender and ethnic differences in the use of PBS, PBS also have not been examined as behavioral outcomes. These PBS represent specific behaviors that are hypothesized to reduce alcohol use and the related effects due to alcohol use. Because the PBS are behaviors, they must be examined as outcomes as well as predictors. The theoretical constructs of self-efficacy and expectations had been examined as predictive of certain behavioral outcomes. Therefore, self-efficacy and expectations related to alcohol will also be included in this study to examine the relationship of one's confidence and expectations with the use of PBS.

The minimal research examining a PBS measure has shown the effectiveness of using PBS in reducing negative effects due to personal alcohol use. Unfortunately, PBS measures had been idiosyncratic and non-standardized such that results of studies can not be directly compared. Research on the development and validation of the PBS scale is also scarce. This was problematic because the PBS items appear to cluster specifically thus casting doubt on the construct validity of the PBS scale. Thus, this study aims to examine the dimensionality, reliability and validity of the PBS. Extensive literature has documented the best methods by which to assess dimensionality, reliability, and validity so this study was guided by existing methodology. By creating a valid and reliable

measure of PBS, future alcohol intervention evaluations can then reliably and validly evaluation harm reduction interventions.

Chapter 3: Methods

This chapter explains the methods utilized in this proposed study. Specific information to be explained and delineated includes: research design, sampling procedure, participation flow chart, recruitment, instrument, survey administration, data collection procedures, response rates, data cleaning/management, delimitations, assumptions, theoretical foundation, analysis plan, missing data, power/sample size, and human subjects procedures.

The data that was used for this analysis was collected at two points from students during the follow-up period of the parent PAF study. Students were recruited to complete the first follow-up survey approximately 60 days after the baseline survey was administered and also after three educational workshops had been implemented roughly two months into the Fall academic semester. The second follow-up survey was administered five months after the first follow-up survey and one month into the second academic semester. This was the first follow-up survey administered and was referred to as 'FU1'. The second set of follow-up data was referred to as 'FU2'. The FU1 data were utilized for all analyses while the FU2 data will only be utilized to assess the test-retest reliability of the PBS items.

Research Design

The study described in this proposal was a secondary analysis study based on data collected as part of an NIAAA alcohol intervention titled "Peers as Family: Preventing Problem Drinking" (PAF). The overall goal of PAF was to evaluate the alcohol-related behavioral outcomes following the intervention. PAF utilized a three-arm intervention-

control trial with a purposive sampling frame. Students were assigned to one of three conditions based on the wing on which they resided (single gender, mixed gender, control). The analyses ran as part of this secondary analysis used only data from student participants who self-reported alcohol use of any type within the 30 days prior to data collection ("drinkers") and was run to examine specifically the underlying dimensionality, reliability and validity of a PBS scale. The surveys administered for the parent study, PAF, were developed in four stages: initial development, pilot testing, revisions, and administration. Existing survey measures related to the parent study aims were identified when available and used either in their entirety or modified for project-specific purposes. The initial web-based survey was then piloted with a group of first-year freshmen to evaluate the accessibility, usability, and data collection methods. The web-based survey was then revised based on pilot testing feedback and cognitive interviews conducted with students. The web-based survey was then used as the primary method of data collection for the PAF project.

The analysis for the scale development of the PBS scale includes four stages as well: literature review, focus groups, development of survey items, and final scale development via factor analysis and reliability analysis (as explained in 'instrument' section below). The first three steps had been completed as part of the initial PAF survey development, and the final step of analyzing the scale items will be described in depth later in this chapter and comprised the specific aims of this secondary analysis.

Cross-sectional data from self-identified drinkers that were collected as part of the parent study (PAF) were utilized to factor analyze the PBS items, examine reliability, and

examine the relationship between the PBS sub-scales and other variables. However, longitudinal data were used to examine the test-retest reliability of each PBS sub-scale.

Parent Study Sampling Procedure

Because this survey was part of a larger National Institutes of Health funded intervention project (PAF, 2005), a purposive sampling frame was adopted to assure that gender and special group learning programs were weighted proportionately among predominantly freshman residence halls thus resulting in a comparison design rather then utilizing a traditional randomized design. A staff member from the University's Department of Resident Life provided the research staff with a spreadsheet with all resident hall composition variables. Those variables included percent freshmen, gender, special-group learning programs, number of students per wing, wing number, and residence hall. The inclusion criteria set to either include or exclude a residence hall wing was that each north campus residence hall must have had at least 4 male and 4 female wings that met the inclusion criteria. The inclusion criteria set for inclusion of individual wings was: wings with a capacity of at least 30 students, resident advisor in charge of single wing, and wing composition had to include at least 70% first year students. The study conditions were assigned to floors that had a male and female wing which met the inclusion criteria. If a floor only had one wing which met the inclusion criteria, then that wing was included and assigned to the control condition. Assignment to study conditions was done so that wing gender, dormitory, and special group learning status were represented proportionately across controls, single, and mixed conditions.

Students were not randomly selected from those wings to participate in any aspect of the study. Rather, all students residing on those wings were invited to participate in the follow-up survey. The survey was sent to each student living on an intervention wing regardless of the study condition it was assigned. The final number of wings was 36 total, with 12 of those being control wings that would not receive any part of the intervention. FU1 was consequently sent to 1269 students, and FU2 was sent to 1155 students. A recruitment flow chart illustrating the parent study recruitment plan follows.

Follow-up #1 (FU1) was administered two months into the Fall 2006 academic semester. Students were allowed 30 days to complete the survey online before the website was de-activated. Follow-up #2 (FU2) was administered six months after the baseline survey, four months after FU1, and one month into the Spring 2007 academic semester. Students were again allowed 30 days to complete the survey online before the website was de-activated.

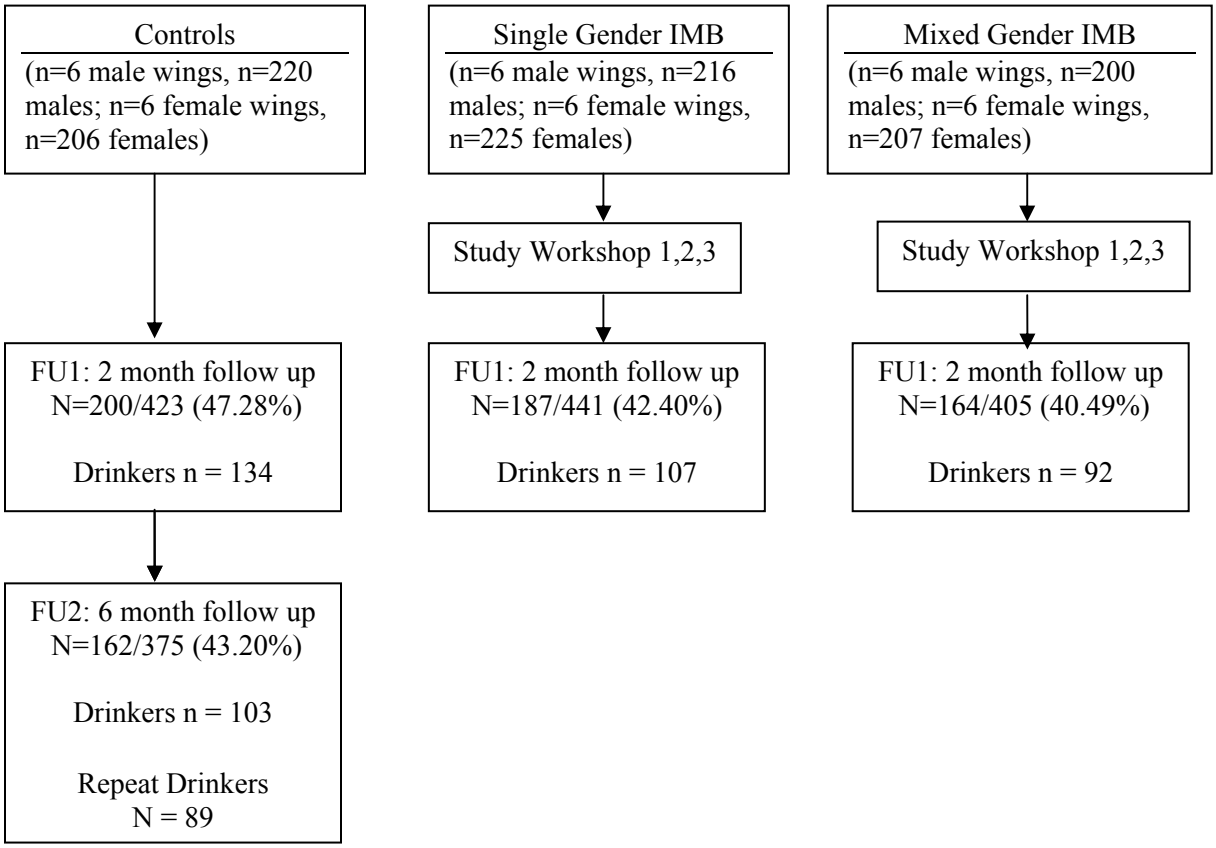

Figure 3.1. Parent Study Participation Flow Chart

Recruitment

The parent study sample included students enrolled in a large, mid-Atlantic university. The university is situated in the middle of three large, urban cities. It was a state school has an enrollment of 25,154 undergraduates, with 21.1% of those classified as freshmen. The student body is ethnically diverse with 56.1% classified as White, and 51.4% of all undergraduates are male. The university also offers traditional housing for those students wishing to reside on campus. There are 20 traditional residence halls, and 16 other apartment/suite style halls located on or near campus with a total of 10,705 students residing in campus housing. Among those students residing in campus housing,

33.9% are first time freshmen, and the majority of those freshmen reside in the traditional residence halls (OIRP, 2006).

Students had been recruited to the project prior to arriving on campus because there was timing conflict with other university-sponsored alcohol education activities. The students selected to complete the PAF survey were initially contacted 2 weeks prior to their arrival on campus. The personalized letter welcomed students to the research project and was scheduled to arrive at each student's home on the day before a personalized email (explained later) was to be sent to each student. Each student's name was printed on the letter. A brief explanation of the project included identifying the intended purpose of the survey as a measure of college students' perceptions of college peer experiences. Because the survey was not limited to collecting data solely on alcohol use, the intent was to recruit students to the survey by stating that it was a survey to measure college students' peer experiences. The letter served to welcome students to the study but also as a method to raise students' awareness of an email that would be sent to students within a day of receiving the letter. The letter also stated that the study was funded by the National Institutes of Health and was printed on University of Maryland Office of Student Affairs stationary. The signatures of the principal investigator of the project and the vice-president of the Student Affairs were also printed on the letter to help validate the study. The letters were then enclosed in an envelope with the University of Maryland Office of Student Affairs logo as the return address. An ink pen with the project name was included in each letter to make the envelope irregular in size with hopes that it would stand out amidst all other mail students receive from campus

organizations. Research has also shown that a token incentive increases participation because students see it as a thank you in advance.

Students (N = 1269; 634 males, 635 females) residing on the selected wings were recruited to complete FU1 with up to five emails and flyers hung in bathroom stalls and elsewhere in their residence hall wing. The emails that were used by the research staff served as the mode of entry into the web-based survey. Each email reminded them of the project and invited them to take the 15 minute survey about college peer experiences. The reminder emails were sent to students once a week for the duration of the follow-up period with daily emails the final three days the survey was live. Survey participants were offered a $10 certificate to the University's bookstore for successful completion of the web-based survey. Additionally, a wing-based incentive of a $40 gift card was offered to all survey respondents on wings that attained an 85% response rate. However, no single wing achieved this high of response rate.

Flyers were also utilized as an invitation for students to participate in the follow-up survey. The flyers alerted students of the NIH funded study, alerted them to an email they would be receiving, and notified them of the incentive they would receive upon completion of the survey. The flyers also stated that the survey would take no more than 15 minutes of the students' time, and they would be able to take the survey from a computer of their choice at a time of their choice. The flyers were printed in color ink on white paper and hung in the bathroom stalls of the selected wings. The flyers were strategically placed in these locations because students who are exposed to recruitment materials in these locations are a captive audience. The resident advisors of each wing

hanged the flyers on the day that students would be moving into the residence halls for the start of the new school year.

Because the response rate of the baseline survey associated with this project was lower than anticipated and hoped, another strategy was implemented to increase student participation. The IRB approved a paper version of the survey and an increased incentive. Two weeks after initial contact was made with students via email, a letter, consent form, and paper survey was sent to students. The letter reminded students of the project and informed them that a wing-based incentive was also up for grabs. Because such a low response was generated for the paper surveys, FU2 was strictly web-based and utilized the emails and flyers as recruitment tools.

The wing-based incentive for FU1 was a $40 gift card to a local merchant for each survey respondent on that wing if 85% of the entire wing completed FU1. It was thought that this incentive would increase excitement about the survey and would get wing-mates to encourage others to complete the survey. However, as mentioned previously, no single wing achieved this high of a response rate. Consequently, for FU2, an individualized raffle was implemented. One student respondent from each study wing was randomly selected to receive a $60 gift card to a local merchant for FU2.

Instrument

All of the data gathered for this study was gathered during the 2006-2007 school year at the University of Maryland. With the exception of 11 paper surveys, all data were collected via the Internet from the web-based survey. Information about the survey

administration and data collection procedures was discussed in greater detail later in this chapter.

Protective Behavioral Strategies (PBS): This section was broken down into two sections; one for those who self-reported recent (within previous 30 days) alcohol use of any type and those who self-reported no recent alcohol use of any type (see page 52 for clarification). Those items in FU1 that only drinkers (D) responded to included the lead-in statement "How often did you do the following since arriving at UM for the Fall 2006 semester?" However, those items which all students (A) responded to included the lead-in statement "Since arriving at UM for the Fall 2006 semester, when you socialized with others, how often did you:" Because of the discrepancy, each section in FU2 included the same lead-in statement "Since arriving back at UM for the Spring 2007 semester, when you socialized with others, how often did you:" The coded response options were 0=never, 1=rarely, 2=sometimes, 3=usually, 4=always. Each of the responses to the respective sub-scales (as generated via factor analysis) was summed together to create a single continuous variable.

The PBS items included:

- Alternate non-alcoholic beverages and alcoholic beverages (D)
- Determine, in advance, not to exceed a set number of drinks (D)
- Eat before and/or during drinking (D)
- Have a friend let you know when you'd had enough (D)
- Keep track of how many drinks you were having (D)
- Pace your drinks to 1 or fewer per hour (D)

- Avoid drinking games (D)
- Stop drinking at least 1-2 hours before going home (D)
- Limit money spent on alcohol (D)
- Only drink in safe environments (D)
- Make your own drinks (D)
- Avoid hard liquor or spirits (D)
- Refuse a drink from a stranger (D)
- Never leave your drink unattended (A)
- Choose not to drink alcohol (A)
- Use a designated driver (A)
- Drink an alcohol look-alike (non-alcoholic beer, etc) (A)
- Hang out with trusted friends (A)
- Carry around a cup but not drink any alcohol (A)
- Use public transportation services (A)
- Avoid situations where there was alcohol (A)
- Participate in activities that did not include alcohol (A)

Alcohol Use: Students were reminded that a drink consisted of a 12 ounce bottle or can of beer, a 5 ounce glass of wine or a wine cooler, or a 1.5 ounce shot of liquor straight or mixed on the web-based survey by including graphics to illustrate appropriate serving sizes of alcohol. Students were asked their frequency of use of alcohol of any type, beer, and liquor or spirits with the following statement "How many days did you use the following substances over the past 30 days?" The coded response options were 0=never,

1=less than once a week, 2=once or twice a week, 3=three or four times a week, 4=five or six times a week, and 5=everyday. These items were taken from the National College Health Assessment (ACHA, 2005). Students were also questioned about their frequency of binge drinking by responding to the following statement "During the past 30 days, on how many days did you have 5 or more drinks of alcohol in a row (MALES) or 4 or more drinks in a row (FEMALE), that is within a couple of hours." This was the standard definition of binge drinking (Wechsler et al., 1994), and the wording of this binge drinking item was taken from the Youth Risk Behavior Surveillance System (CDC, 2006). The coded response options were the same as above. Students were also asked how many drinks they consumed during a typical day of the week (Sunday through Saturday) during the semester by responding to the statement "During a typical week in the past 30 days, how many drinks did you consume on each day of the week?" The coded response options were 0=none, 1=one, 2=two, 3=three, 4=four, and 5=5 or more. This daily alcohol use item was created by the principal investigator to validate the previous consumption items. Each daily alcohol use item was summed to create a single "weekly alcohol use" continuous item to be utilized in the theoretical framework as an outcome of interest. The other alcohol use outcomes to be examined as outcomes of interest were frequency of binge drinking, days used beer, and days used liquor.

The alcohol use items of frequency of use of beer, wine, liquor, and/or alcohol of any type were used to identify drinkers. Students who reported positive consumption (at least one day) of any of those four items were classified as a self-reported drinker. These students whom self-reported alcohol use of any type were classified as drinkers and comprise the sample which was included in the analyses outlined in this specific study.

Negative Alcohol Effects: The 2003-2004 National Study of Living Learning Programs (NSLLP) instrument (Inkelas, Brower, Crawford, et al., 2004) contained items measuring students' experience with negative consequences as a result of their own alcohol use. Students were asked to respond to the following statement "How often did you experience any of the following as a result of your own alcohol use since arriving at UM for the (respective) semester?" The coded response options for all items were 0=none, 1=once, 2=twice, 3=three or more times. The original scale was broken down into 'physical & legal', 'health', 'emotional', and 'sexual' consequences of alcohol. The alpha levels were .706, .783, .725, and .647 respectively (Inkelas et al., 2004). Because the alpha levels were low and subsequent psychometric analysis of the items supported a single variable (PAF, 2005) all of these items was summed together to create a single continuous item for purposes of this study. The specific items are as follows:

- I missed or performed poorly in class
- I was confronted by a residence hall staff member
- I had a hangover
- I became sick or vomited
- I passed out
- I had memory loss or blackouts
- I physically harmed myself or another person
- I caused a disturbance (i.e., was noisy)
- I damaged property
- I had unprotected sex
- I received a citation or was arrested

- I regretted getting sexually involved with someone
- I coerced another person into being sexual with me
- I was ashamed by my behavior
- I had a conflict with my roommate or another person
- I fell behind in my studies
- I regretted losing control of my senses
- I was late for work or school

Alcohol Abstinence Expectations: One sub-scale of the Comprehensive Effects of Alcohol (Fromme & Corbin, 2004) was used to measure how students perceived the effects from abstaining from alcohol. The eight items from the sociability sub-scale were used to comprise the positive effects of abstaining from alcohol. These lead-in statement instructed students to "answer the following questions based on whether or not you would expect the effect to happen to you if you refrained from drinking alcohol". Coded responses options were 1=disagree, 2=somewhat disagree, 3=somewhat agree, and 4=agree. These items were summed to create a single continuous item. This sub-scale (with original wording and context) had good reliability with a Cronbach's alpha of .84. The specific items are as follows:

- I would be outgoing
- I would be humorous
- It would be easy to express my feelings
- I would be friendly
- I would feel energetic

- It would be easy to talk to people
- I would be talkative
- I would act sociable

Drunkenness Avoidance Self-Efficacy: Four items were created by research staff members to gain a better understanding of students' confidence in using certain behavioral skills to avoid drinking to the point of getting drunk. These four items had a Cronbach's alpha coefficient of .80 and loaded on a single factor after initial factor analysis (PAF, 2005). Students were instructed to respond to each item based on "how confident are you that you could do the following?" The coded response options were 1=unconfident, 2=somewhat unconfident, 3=somewhat confident, and 4=confident. The responses to each of the four items were summed to create a single continuous item. The four items are as follows:

- Alternate non-alcoholic beverages and alcoholic beverages
- Determine, in advance, not to exceed a set number of drinks
- Pace your drinks to 1 or fewer per hour
- Keep track of how many drinks you were having

Protection Self-efficacy: Eight alcohol protection self-efficacy items were created by research staff members to gain a better understanding of students' confidence in limiting their alcohol use and ability to drink more responsibly. These eight items had a Cronbach's alpha coefficient of .84 and loaded on a single factor after initial factor analysis (PAF, 2005). Students were instructed to respond to each of the nine items

based on "how confident are you that you could do the following with your wing-mates?" The coded response options were 1=unconfident, 2=somewhat unconfident, 3=somewhat confident, and 4=confident. Students' responses to all nine items were summed to create a single continuous item. The specific items are as follows:

- Avoid drinking too much
- Resist pressure from a wing-mate to drink too much
- Avoid being in situations where you would be encouraged to drink too much
- Avoid drinking games
- Drink an alcohol look-alike
- Carry around a cup but not drink any alcohol
- Socialize with my wing-mates in a manner that does not include alcohol
- Avoid driving after you had been drinking
- Avoid riding with a driver who has been drinking

Refusal Self-Efficacy: Four items were borrowed from Oei, Hasking and Young's Drinking Refusal Self-Efficacy questionnaire (2005). The original items loaded on a single factor that was renamed 'social pressure drinking refusal self-efficacy' and had acceptable internal consistency (α = .83). Students were instructed to respond to each item based on how sure they could resist drinking in certain situations. The coded response items were 1=I am very sure I could NOT resist drinking, 2=I most likely could NOT resist drinking, 3=I probably could NOT resist drinking, 4=I probably could resist drinking, 5=I most likely could resist drinking, 6=I am very sure I could resist drinking.

The responses to all items were summed to create a single continuous item. The specific items are:

- When someone offers me a drink
- When my boy/girl friend or partner is drinking
- When my friends are drinking
- When I am at a party or club

Survey Administration

The University of Maryland Institutional Review Board approved all procedures involved in recruiting student participants and implementing the study. Because students aged seventeen may had been recruited, assent forms were necessary. However, because the surveys were completed online, the assent form and consent form was combined into a single assent/consent form that all students were required to electronically 'sign' before they were able to submit any data to the research staff.

Each email contained a hot link to the survey web page. Once students entered the PAF survey web-site, they were immediately required to read the combined assent/consent form. Students were required to enter their birthday and the unique study identification number that was included in their email as acceptance of the consenting process. Once students 'signed' and submitted their consent/assent form, they were taken to the survey. The instrument was developed by the PAF research staff, and the items are described previously. Once students had completed each page of the web-based survey, they were instructed to 'submit' their responses. If an item was missed, the student was alerted to the skipped question and asked if he/she would like to answer the missed item.

Once all survey responses were submitted by the student, an incentive page popped up. This informed students that their bookstore coupon would be sent to them via campus mail. A confirmation page was also shown to students. This confirmation page thanked students for their participation and provided information to all students regarding alcohol use behaviors and campus resources. The campus resources included telephone numbers to the University Police, Health Center, Counseling Center, and night transportation service. Information was also included to identify those behaviors which are illegal such as sexual intercourse with an intoxicated individual, abuse, and other alcohol related behaviors. This confirmation page was in accordance to the recommendation provided by the Data Safety and Monitoring Board that oversees the PAF project, data, and participants.

As mentioned previously, a paper version of the survey was also sent to students who had not yet completed FU1 after two email reminders had been sent. The students were required to enter their birthdates and unique study identification number on the consent page. The paper survey was the same as the web version except there were no skip patterns for non-drinkers. Rather, a response option of "never drank" was added for appropriate items that were not applicable to non-drinkers, even though the only data used for this specific study is that of self-identified drinkers. Students were then instructed to send the completed paper survey to the research staff in the provided return envelopes. A reminder was also included at the end of the survey that the bookstore coupon incentives would be sent to students upon receipt of the survey data.

Data Collection Procedures

All web data submitted by students was simultaneously entered into a password-protected Access database hosted on a web server. This database had previously been set up by the research staff with all labels and values for each item submitted. This electronic and simultaneous method of data collection assured that human error during data entry would not be a factor. The database was backed up everyday onto a different server to assure that no data were lost. Those students who did not submit complete data were alerted via email that their data were incomplete and this may affect their ability to qualify for the incentive. Those students were then given the opportunity to fully complete the survey.

The paper data were retrieved through campus mail. Upon receipt of paper data, a research staff member verified the student's study identification number and birth-date. The data were then entered twice by two different members of the research staff. A third research member then checked the duplicate responses for errors. Once all data were verified, the paper data were then merged with the web data.

Response Rates

Out of 1,269 students recruited to participate in FU1, 551 students provided acceptable data for a response rate of 43.4%. Only twelve paper surveys were received (one duplicate of web data) and the remaining 540 students completed the survey on the Internet. Of the 551 total respondents, 58.8% were female, 68.1% were 18 years of age, 60.3% were White, 59.3% belonged to a living-learning program (special groups in which students with similar academic interests follow the same academic program and

live together in residence halls), and 90.4% were first-year freshmen. More females and more members of a living-learning program completed the survey than are represented on campus. The University of Maryland distribution of first-year freshmen is 55.4% male, 42.2% members of living-learning program, 59.3% White.

Because this was a study to examine the relationship between use of PBS and alcohol use and the related negative effects, only self-reported drinkers were included in the data analysis. Of the 551 survey respondents, 333 students were identified as drinkers based on their self-reported use of alcohol. Among those drinkers, 92.0% were first-time freshmen, 58.9% were female, 75.5% were 18 years of age, and 70.1% were White. Among those students identified as drinkers in FU1, 187 completed the FU2 survey and again self-reported as a drinker.

Because FU2 was administered during the second semester, some students moved off of the intervention wings. Therefore the sample size at FU2 was 1,155 with 502 students submitting acceptable data for a response rate of 43.5%. Of those 502 respondents, 56.4% were female, 62.9% were 18 years of age, 64.1% were White, 51.4% were LL members, and 90.9% were first-year students. Among those 89 drinkers in the control study group who completed both the FU1 and FU2 surveys, 61.8% were female, 65.2% were 18 years of age, 67.4% were White, 64.0% were LL members, and 95.5% were first-year students. This group of students was used for the test-retest reliability analysis of the PBS items.

Data Cleaning/Management

Because this was a web-based survey, students who completed the survey did so via an Internet server. The web-survey was constructed in pages, and students had to submit their data before moving on to the next section. Once students submitted survey data at the end of each page, the data were automatically saved in an Access database that was linked to the web-survey server. The survey database was automatically backed up each day by the web server. Each survey entry was examined for completion prior to sending the incentive coupon to students. If students did not complete the alcohol use items and at least one other section, students were sent an email notifying them of their incomplete survey entry and given another chance to complete the survey.

Upon receipt of any paper data, a staff member entered the data into the SPSS database. A second staff member then entered all data a second time into the same database. A third and unique staff member then examined the duplicate entries for reliability of data entry. If discrepancies were identified, a fourth staff member examined the hard copies of the data and corrected the data.

Prior to exporting all survey data into SPSS, version 14.0, a codebook was created for each survey item, and the SPSS database was developed. Once all survey data had been collected, the data were exported into the SPSS database, merged with the paper survey data, and automatically coded based on the database. Once all data were exported into SPSS, the data were examined for completeness and acceptability of data. If data were not varied based on sections and the time of completion was not adequate, that data were deemed unreliable and not included for final analysis. Other self-report data were compared with administrative data to assure that students' gender and residence hall

assignment was accurate. A total of 28 cases were deleted from the FU1 database due to incomplete data (21 cases), no alcohol use information (4 cases), and unreliable data (3 cases). Among data received at FU2, 10 cases were deleted from the final FU2 database due to incomplete data (2 cases) and unreliable data (8 cases).

Delimitations

This study was delimited to those students living in predominantly freshmen residence halls at the University of Maryland who completed the follow-up survey of the "Peers as Family: Preventing Problem Drinking" project. A purposive, non-randomized sample was selected from a list of wings from those predominantly freshmen wings by the Principal Investigator to assure that a balanced selection was attained among gender and living-learning status. The study was also delimited to those students who self-reported alcohol use behaviors within the 30 days prior to completing the survey as this study was focused solely on self-reported college drinkers.

Assumptions

One assumption surrounding this study was that those students who responded to the survey did so honestly and self-disclosed accurate alcohol use behaviors. It was also assumed that the scales used in the instrument were accurate measures of the intended variables for this college sample. A final assumption was that the PBS identified in the literature and by students accurately reflects those strategies commonly used among drinkers.

Analysis Plan

The following information is a detailed explanation of the methods to be used to analyze each of the specific aims listed in chapter 1. Additionally, univariate analyses were ran to examine the initial frequencies and distributions of each variable of interest, and the bivariate relationships among all variables of interest. Furthermore, an initial examination of the mean differences between PBS item responses based on gender (male, female) and race (White vs. non-White) was conducted.

Aim#1: Examine the dimensionality of the PBS scale for all students and for gender and race/ethnicity subgroups

Hypothesis #1: The PBS items will represent a multi-dimensional scale.

Factor analysis is a complex statistical tool that begins by assessing all observed data retained from respondents. The data then is examined on a correlational level and then loaded onto specific factors based on how well items are related to each other (Kachigan, 1991; Nunnally & Bernstein, 1994; Clark & Watson, 1995; DeVellis, 2003). The correlation is a number that represents the relationship between two items and is conducted for each possible pair of variables. The factor loadings are generated by then conducting a series of matrix formulations to determine a more precise relationship among all items. Factor loadings are generated which represent the more precise correlation of each item with all other items. High factor loadings represent items that group well together while low factor loadings represent a weaker relationship.

Each factor (or group of items) is then extracted and an explained variance is generated for each factor. Typically, an eigenvalue of at least 1 is set as the minimum for a factor to be retained in the final output of the factor analysis. An eigenvalue is representative of the percentage of variance explained by each of the factors extracted via PCA (Bryant & Yarnold, 2000). The eigenvalue takes into consideration the number of items that are grouped within a certain factor and how much of the overall scale can be accounted for (or the variance explained) by that specific factor. The variance explained can be used in the final decision of how many factors to retain. Another tool to use when determining how many factors to retain is the comprehensibility of the items and how they are grouped. This can be a subjective criteria but a critical component based on the items that load on certain factors and how well they relate to the overall construct to be measured (Kachigan, 1991; Clark & Watson, 1995; Floyd and Widaman, 1995).

Another tool to consider when conducting a factor analysis is the rotation of the factors. Factor analysis is essentially a method to extract certain items that are closely related to one another; therefore the idea of extraction is central to the factor analysis procedures (Floyd & Widaman, 1995; DeVellis, 2003). In an un-rotated analysis, the factor loadings for each item may be very similar across multiple factors. However, once the initial factors are extracted, rotation of the axes of the initial factors allows for the variance of each initial factor to be redistributed (or redefined) resulting in a more theoretical and meaningful factor pattern. It must be noted, however, that rotating the factors does not result in a change of the number of factors or the amount of total variance explained by the factors (Kachigan, 1991). Rather, this technique only serves to provide a clearer illustration of how each variable loads on the specific factors (Hair et

al., 1998). Once the rotated factor loadings had been examined, one can again look at the factors and the items that load on each factor and make a decision as to how many factors to keep based on the original conceptual ideal. Each factor would then become a sub-scale, which is part of the larger conceptual scale, and each sub-scale can be named based on the construct it measures (Kachigan, 1991; DeVellis, 2003).

The PBS items that were included in the analysis were all 22 items included in the survey. As described previously, 16 of those items were included in the "drinker" section while the remaining 8 items were items in which all students regardless of drinking status were asked to respond. The coded response options for each item were 0= never, 1=rarely, 2=sometimes, 3=usually, and 4=always. The items were organized in 2 separate sections on the web-based survey to minimize any confusion as to how students who did not use alcohol would respond to the items and to reduce the length of the survey.

Exploratory factor analysis was performed to indicate the initial factor structure of the PBS scale. The steps to be followed while conducting exploratory factor analysis are (Kachigan, 1991):

1. Correlation matrix
2. Factor extraction
3. Examination of eigenvalues and percentage of variance explained
4. Scree plot
5. Factor matrix
6. Examination of factor loadings and communalities
7. Procrustes rotation

8. Examination of residual matrix and coefficients of non-determination
9. Comprehension of factors
10. Inclusion and naming of factors

Factor analysis was run for the entire sample as well as for the gender specific samples and the entire sample examining racial differences, utilizing FU1data (as explained on page 43). After running factor analysis for the entire sample of college student drinkers, factor analysis was repeated with gender then race being partialed out separately to identify differences in the underlying factor structure based on gender and race. The sub-sample differences (if differences are present) was retained and utilized in the subsequent analyses outlined below. Keeping in mind that the goal of factor analysis is to define and provide insight to the underlying structure of a related group of items (Kachigan, 1991; Nunnally & Bernstein, 1994; Floyd & Widaman, 1995; Clark & Watson, 1995; Hair, Anderson, Tatham, Hope, & Black, 1998), the first step was to examine the bivariate correlations of all 22 items to determine the initial relationships among items. A correlation matrix was produced. In terms of factor analysis, high collinearity was not a negative outcome as the goal is to minimize related items into a single item (Hair et al., 1998). By examining the correlation matrix, an initial understanding of the relationships between all PBS items was achieved.

The next step of the common factor analysis was to run the data reduction utilizing Principal Components Analysis (PCA). PCA seeks to extract the maximum variance from all of the variables. Once the maximum variance is removed from each cluster of related variables, PCA continues to seek the next maximal proportion variance

from the remaining variance-until all variance has been accounted for among all variables. The first extracted factor accounts for the largest part of the variance, the second factor accounts for less variance than the first, and so on (Kachigan, 1991). Additionally, each "factor" is viewed as a weighted combination of the input variables (Kachigan, 1991). The variances that are subsequently extracted and identified during the factor analysis procedures are referred to as eigenvalues (Bryant & Yarnold, 2000). An eigenvalue is representative of the percentage of variance explained by each of the factors extracted via PCA (Bryant & Yarnold, 2000). An eigenvalue of 1 was set as the cut-off value of possible inclusion for unique factors (Nunnally & Bernstein, 1994; Hair et al., 1998) as this was recommended when the number of variables is between 20 and 50 (Hair et al., 1998) and PCA was run initially with all 22 of the PBS items. Thus, each factor that has as eigenvalue of 1 or higher was retained for possible inclusion in the final factor structure (Kachigan, 1991).

The percentage of variance explained by each factor extracted during PCA will also be examined as will the Scree plot. A Scree plot is a chart that illustrates the incremental variance accounted for by each successive factor extracted during factor analysis and rotation. By examining the Scree plot, eigenvalues, and percentage of variance explained, a better understanding of the unique contribution of each factor can be attained (Kachigan, 1991; Bryant & Yarnold, 2000). These outputs provided further insight as to the unique contributions of the variables and to the final number of factors to include in the overall analysis.

The next step was to examine the unrotated and rotated factor matrix. The factor matrix identifies and illustrates the factor loadings of each item on the unique factors

extracted and is necessary to dictate the final factor solution (Hair et al., 1998; Clark & Watson, 1995; Nunnally & Bernstein, 1994). Furthermore, a rotated matrix is a redefinition of the factors and and provides a clearer delineation of the number of factors by rotating the axes of the factors (Nunnally & Bernstein, 1994; Clark & Watson, 1995; Hair et al., 1998). VARIMAX and PROMAX rotated factor matrices helped to further delineate the number of factors and the items that loaded on each factor. By using multiple rotation methods, further understanding of the unique loadings on each factor was attained.

Upon examination of all of the variations of the rotated factor matrices, the factor loading coefficients (factor loadings) which represented the correlational relationship between the variables and the factors (Bryant & Yarnold, 2000), were examined. Along with an examination of the factor loadings, the communalities of each variable were examined. The communality of an item indicates the amount of variance a single variable shares with the other variables in the analysis (Bryant & Yarnold, 2000).

A factor loading of at least .30 was the lowest acceptable loading for an item to be included in a specific factor (Clark & Watson, 1995, Floyd & Widaman, 1995; Hair et al., 1998). However, a factor loading of .50 or higher denoted practical significance (Hair et al., 1998). According to Hair et al. (1998), with a sample size of at least 250, a factor loading of .35 is acceptable based on an alpha level of .05 and a power level of .80. Because this was an exploratory factor analysis, a factor loading of .35 was set as the inclusion level to retain a single variable as part of a factor. Additionally, if a single item loaded on multiple factors or was related to multiple variables (ie: had high communalities) (Hair et al., 1998), a decision was made as to which factor to include that

item. The decision was a theoretically, intuitively-based, and statistical decision to shed more light on the final factor structure. Conversely, if an item did not have an acceptable factor loading on any factor (represented by a coefficient of no greater than .30 on any single factor) or if the residual matrices (produced via procrustes rotation method) indicated that certain variables had poor fit across samples, that item was explored for possible deletion. The decision to delete the item can be based on a small coefficient and low reliability as well as a theoretical judgment based on the overall factor structure and interpretability of the overall scale (Hair et al., 1998).

Once all of the previous steps had been completed, the final step of the factor analysis was to identify how many factors to retain and to label the factors based on an appropriate interpretive explanation of the combined items and to analyze the reliability of each sub-scale. Hypothesized sub-scales have previously been identified based on an initial face validity analysis (in Chapter 1). However, this was an exploratory (rather than confirmatory) study. Therefore, the final scale structure was based upon the factor analysis results. Therefore, the actual sub-scales may differ from what was originally hypothesized, and the actual sub-scales was created and utilized in all subsequent analytical procedures identified and described in the following paragraphs. Specifically, the number of factors to retain was based on those factors whose eigenvalues are at least 1.0, all items within a specific factor have high factor loadings, and the remaining factors are theoretically and intuitively interpretable.

Because the PBS underlying scale structure had not been examined for specific sub-groups (males, females, whites, non-whites), it was important to examine the potential non-congruence of the factor structure among males and females as well as for

whites and non-whites. However, as explained previously, it was not possible to run factor analysis and compare different groups by merely comparing the factor loadings and eigenvalues. Therefore, the procrustes rotation method (Schönemann, 1966) was utilized to examine the level of congruence (or similarity) between the male and female factors as well as between the white and non-white factors. The procrustes method rotates, translates, stretches, and shrinks the factors from each sample until a matrix of best fit was obtained which represents both samples as adequately as possible (Schönemann & Carroll, 1970). The rotation method then allows for direct comparison to be made between two distinct samples to identify similarities and differences between the samples and to identify the best fitting solution for the factor structure (Gorsuch, 1966).

From the procrustes rotation method, a residual matrix was produced to identify lack of fit among the factors between the sub-groups (males, females; whites, non-whites). This residual matrix was used to identify variables which can be removed from the final factor structure because of lack of congruence across samples. If specific variables are shown to be inconsistent across sub-groups, those variables was removed and the remaining variables was retained and utilized in the dimensionality, reliability, and validity testing with the total sample of college student drinkers.

Aim #2: Examine the internal consistency and test-retest reliability of the PBS scale, and/or sub-scales

Hypothesis #2: The entire PBS scale and/or each of the sub-scales will represent a reliable measure.

Internal consistency is a critical component of a scale in that repeated measures across times is vital. Internal consistency refers to "the overall degree to which the items that make up a scale are inter-correlated" (Clark & Watson, 1995) and is often referred to as reliability. Reliability can be measured by means of a few analyses. To assess the reliability of the PBS scale, the following statistics were examined for the entire sample as well as for each group (males, females, Whites, non-Whites):

1. Inter-item correlations
2. Descriptives for
    a. Each item
    b. Total scale
    c. Scale if item deleted
3. Cronbach's alpha coefficient
4. Test-retest reliability coefficient

Using data from FU1, inter-item correlations were examined between all of the PBS items. Each item in the potential PBS scale will then undergo an initial reliability testing. Initially, each item was entered into SPSS reliability analysis. Descriptives for item, scale and scale if item deleted was run for all 22 items. Additionally, Cronbach's alpha coefficients were examined for the total 22 items. The Cronbach's alpha coefficient is indicative of the proportion of the "scale's total variance that is attributable to a common source [a single unidimensional construct], presumably the true score of a latent [apparent] variable underlying the [set of] items" (DeVellis, 2003). Stated in simpler terms, the Cronbach's alpha coefficient is a common measure of internal consistency (reliability) that represents the strength of inter-correlations among a set of

variables. The Cronbach's alpha coefficient also indicates how well that set of items measures a single construct. This initial reliability analysis helped to focus validity testing by putting the initial relationship into context.

After all 22 items had been put through structural validity testing utilizing factor analysis, each sub-scale were put through reliability analysis. Those items which loaded on specific factors were treated as separate groups. PBS items which had significant inter-item correlations as defined by correlation coefficients of at least .20 were retained for the final scale construction (Clark & Watson, 1995, Floyd and Widaman, 1995). The mean and standard deviation for each item was generated as well as the scale mean and variance if an individual item were deleted. Finally, the corrected item-total correlation and the Cronbach's alpha if an individual item were deleted were obtained for each sub-scale. If a single item led to a higher Cronbach's alpha coefficient if that item was deleted, that item was examined for deletion. In total, the inter-item correlations, corrected item-total correlations, and Cronbach's alpha if the item is deleted were examined to identify potential items that could be deleted to result if a more reliable and valid sub-scale. An alpha level of at least .70 was deemed acceptable for exploratory research and that level was set as the cut-off for inclusion of a sub-scale in the final scale construction (Cronbach, 1951; Hair et al., 1998; DeVellis, 2003).

Once the initial reliability testing was completed, data from those students assigned to the control condition were utilized to examine the test-retest reliability of the PBS scale. Because of the parent study's aims to evaluate the effectiveness of a series of three workshops on the alcohol-related outcomes, only those data from students assigned to the control conditions at FU1 and FU2 were used to asses test-retest reliability for each

sub-scale identified from factor analysis and psychometric testing due to possible parent study intervention effects in the changes in behavior. To examine test-retest reliability, the Pearson product moment correlation coefficient was produced. A correlation coefficient of .90 is usually deemed acceptable because less than 20% of the variance is unaccounted for (Kachigan, 1991).

Once an acceptable and stable Cronbach's alpha coefficient was obtained and test-retest reliability had been confirmed, additional measures of construct validity were examined by assessing the relationships among PBS sub-scales and other variables of interest.

Additionally, once acceptable internal consistency was achieved for all sub-scales, each item in the respective sub-scales was then summed to create a single summative score. This summative score was subsequently treated as a continuous variable and was used in further validity analysis examining the construct (convergent and discriminant) validity by examining the Pearson product moment correlation coefficients.

Aim #3: Examine the construct validity among the PBS sub-scales and between the PBS sub-scales and the predictors and outcomes for all students

> **Hypothesis #3a**: Alcohol avoidance PBS were expected to converge on the theoretical predictors and outcomes of alcohol abstinence expectations, refusal self-efficacy, protection self-efficacy, alcohol use, and negative alcohol effects and were expected to diverge from the theoretical predictor drunkenness avoidance self-efficacy.

Hypothesis #3b: Drinking responsibly PBS were expected to converge on the theoretical predictors and outcomes of protection self-efficacy, drunkenness avoidance self-efficacy, and negative alcohol effects and were expected to diverge from the theoretical predictors and outcomes of alcohol abstinence expectations, refusal self-efficacy, and alcohol use.

Hypothesis #3c: Safe environments PBS were expected to converge on the theoretical predictors and outcomes of protection self-efficacy and negative alcohol effects and were expected to diverge from the theoretical predictors and outcomes of alcohol abstinence expectations, refusal self-efficacy, drunkenness avoidance self-efficacy and alcohol use.

The results from the convergent and discriminant validity analysis provided support for construct validity such that by assessing convergent and discriminant validity, support can be generated for the theoretical and hypothesized foundation of the scale based on relationships that exist among all of the sub-scales identified through factor analysis (Nunnally & Bernstein, 1994). Convergent and discriminant validities are assessed by examining the relationships among variables of interest. By correlating two measures of interest, the strength of those correlations provides further description of the validity of the scale. Convergent validity refers to the high inter-correlations (positive or negative) between two measures that should measure a similar construct. Discriminant validity refers to the low, non-significant (positive or negative) correlations between two measures that should not measure a similar construct (Kachigan, 1991; Nunnally & Bernstein, 1994; Trochim, 2001)

Once an acceptable Cronbach's alpha coefficient was obtained for each PBS sub-scale (generated via factor analysis and reliability analysis), the convergent and discriminant validities were assessed by examining the relationship between each of the PBS sub-scales extracted during factor analysis for the whole sample. Multiple correlation coefficients (*R*) were produced for each pair of the PBS sub-scale utilizing linear regression with study condition, living-learning membership, gender and race as covariates in each model. The *R* represents the combined relationship between multiple independent variables and the single dependent variable (Kachigan, 1991). However, because specific demographics were controlled for (study condition, living-learning memberships, gender and race), the part and partial correlations were examined to account for only the relationship between the PBS sub-scales and the alcohol-related variables of interest. Partial ($Part^2$) refers to the additional proportion by the variable of interest as a ratio of how much was left to explain. The semi-partial ($Partial^2$) is the proportion of variance explained above and beyond the other variables in the model (or R^2 change) (Hair et al., 1998). However, for the purposes of this study, only the part and partial correlations (rather than correlations squared) will be examined. By examining the part and partial correlations, the amount of variation in the dependent variable that is accounted for by the set of independent variables can be identified (Kachigan, 1991, Hair et al., 1998). Because study condition, living-learning membership, gender and race were identified as potential confounding factors on the outcomes of interest, study condition, living-learning membership, gender and race were included in each correlational analysis to further validate the use of PBS for the different sub-groups of college students. It should be reiterated, however, that the goal of this study was not to identify the most

parsimonious predictive model. Rather, the relationships among PBS sub-scales and between the PBS sub-scales and other independent (expectations and self-efficacy) and dependent variables (alcohol use and negative effects) were of interest with respect to this secondary analysis.

Because study condition, living-learning membership, gender and race were included in the correlational analyses, a simple bivariate correlation could not be produced. Therefore, multiple linear regression was utilized to examine the effect of each predictor variable, study condition, living-learning membership, gender and race on the outcomes of interest. Via linear regression analysis, the part and partial correlations were produced which represented the strength of association between the variables above and beyond the effect of the demographics variables (Hair et al., 1998). Correlations are acceptable when both the independent and outcome variables are treated as continuous variables, have linear relationships, are measured on an interval or ratio scale, and are normally distributed (Kachigan, 1991). Study condition (control as the reference), living-learning membership (member, non-member), gender (male, female) and race (white, non-white) was treated as dichotomous covariates. The purpose of using linear regression to assess validity for this study is that of assessing the strength and magnitude of the relationships among the variables of interest (Hair et al., 1998) while examining the combined effect of the independent variables on the dependent variable. Because so many demographic variables were included in the regression analysis, it was important to examine the partial and semi-partial correlations. Each of the specific pairs of relationships to be tested had been theoretically driven and described in the previous chapters.

High, significant correlations (regardless of direction) will provide support to convergent validity whereas low, non-significant (regardless of direction) correlations will provide support for discriminant validity. A minimum correlation of .40 (regardless of direction) was the cut-off point for generating support for convergent validity (Di Iorio, 2005). Evidence for discriminant validity was generated if the correlation between two variables is statistically non-significant with a correlation less than .40 (regardless of direction). The data from FU1 was utilized for this analysis by running separate linear regressions for each relationship of interest while including study condition, living-learning membership, gender and race as covariates. The correlation was presented to show convergence or divergence among the PBS sub-scales and the variables of interest. By running regression with gender and race included in the model, the relationships was more powerful and more explanatory than merely examining the bivariate relationship specifically because of the possible confounding effect of gender and/or race/ethnicity. Specifically, the relationships that were examined are illustrated in the following figure and described in detail in the following pages.

	Alcohol avoidance	Drinking responsibly	Safe environments
Drinking responsibly PBS	**R**		
Safe environments PBS	**R**	**R**	
Alcohol abstinence expectations	**R**	X	X
Refusal self-efficacy	**R**	X	X
Protection self-efficacy	**R**	**R**	**R**
Drunkenness avoidance self-efficacy	X	**R**	X
Days use beer	**R**	X	X
Days use liquor	**R**	X	X
Days use alcohol of any type	**R**	X	X
Days binge	**R**	X	X
Weekly use	**R**	X	X
Negative alcohol effects	**R**	**R**	**R**

Figure 1.2. Exploratory Correlation Matrix Identifying Expected Relationships

R indicates expected significant relationship (convergent validity).
X indicates no expected significant relationship (discriminant validity).

Because the proposed mechanism of change is different for each dimension and the proposed behavioral outcomes are different for each dimension, relationships were identified for each PBS dimension with the predictors and outcomes. However, it was important to note that this study is exploratory in nature. Therefore, the goal of establishing convergent validity was not to identify the most parsimonious model for predicting use of PBS or for predicting alcohol use or negative alcohol effects. Rather, the relationships as illustrated in Figure 1.2 were focused on for this specific aim.

For this study, the predictors of using PBS are alcohol abstinence expectations and the measures of self-efficacy (refusal, protection, and drunkenness avoidance). The outcomes of interest are alcohol use (weekly use, binge drinking, days use beer and liquor

and alcohol of any type) and negative alcohol-related effects. Convergent validity is important because the PBS constructs should be able to predict and be predicted by measures which are hypothesized (Nunnally & Bernstein, 1994; Trochim, 2001) and can further shed light on the importance of PBS and the usability of PBS in evaluating alcohol programs. The expected relationships are identified in the Correlation Matrix above (Figure 1.2).

While different PBS sub-scales may be related differently with the outcomes of interest, there may also be different mechanisms of change in terms of getting students to use certain PBS. This mechanism of change is crucial to understand because of its intervention and programmatic implications. One issue of the construct validity of the PBS items is that the individual items may cluster together in a way which limits their use among all types of students and in all types of situations. To gain a better understanding of which factors may be related to students' use of PBS, Pearson product moment correlation coefficients was examined to identify the relationship of the independent variables (expectations and self-efficacy), the outcomes of interest, and the PBS sub-scales.

Convergent validity was supported by a significant relationship as identified by part and partial correlations of at least .40 (Di Iorio, 2005). The data from FU1 was utilized for this analysis by initially examining the part and partial correlations for each of the variables of interest for the entire sample. Specifically, alcohol abstinence expectations were correlated with each of the PBS sub-scales. Each self-efficacy construct will then be correlated with each of the PBS sub-scale. Each PBS sub-scale

will then be correlated with each of the alcohol use items. Finally, each PBS sub-scale was correlated with negative alcohol effects.

Study condition, living-learning membership, gender and race were included in each individual analysis as explained previously. Specifically, study condition, living-learning membership, gender, race, and the independent variable were all entered into a single regression block to examine the combined effect of the independent variables on the dependent variable of interest. In regression analysis, each of the predictor variables (including gender and race) are combined and a weighted combination of the total independent variables is considered when determining how much of the variation of the dependent variable is explained by the combined efforts of the independent variables (Kachigan, 1991). The expected relationships (significant, non-significant) are illustrated in Figure 2, the Correlation Matrix, above.

Missing Data

All data collected was analyzed for missing responses. Frequencies of missing data were examined to identify how much data are missing and whether the missing data are systematic or random. Further, data from both FU1 and FU2 was examined to identify whether the missing data are repeated or unique. Finally, the best option for dealing with the missing data was explored based upon the results from the initial analysis. One option to deal with missing data was the item-mean substitution method (IMS). The IMS method replaces each missing item with the individual item means. This technique is considered acceptable for Likert-type responses when the number of missing items is 20% or less (Downey and King, 1998) and when the missing data are

random in nature. SPSS version 14.0 was also capable of handing this type of approach. If data were missing systematically by individual case and over 20% of the cases skipped that item, a decision was made to exclude that case from further analysis. If the data are missing systematically per individual case by more than 20%, that case was excluded from further analysis.

Power/Sample Size

It was recommended that a minimum of 5 cases per variable be attained to successfully run a factor analysis (Hair et al., 1998). However, it was more optimal to have at least 10 cases per variable examined (DeVellis, 2003). Because there were 22 variables included in the PBS variable set, a sample size of at least 220 is acceptable. There were 320 identified drinkers from the follow-up survey. Therefore, according to Hair et al. (1998), with a sample size of 320, a factor loading of .35 was acceptable based on an alpha level of .05 and a power level of .80. Furthermore with a sample size of 320 setting the alpha level at .05 and the power level at .80, a moderate effect can be detected when testing the correlational relationships between the PBS items and the variables of interest (Hair et al., 1998) Consequently, there was enough power to detect adequate scaling as well as construct, discriminant, and convergent validity based on the achieved sample size.

Human Subjects Procedures

All data collection procedures utilized during the initial data collection period was approved by the University of Maryland Institutional Review Board. Additionally, IRB

approval has been received for this specific secondary analysis examining the PBS utilized by college student drinkers. Risks to participants were minimal. No student was excluded from the study based on gender or racial/ethnic characteristics. Additionally, all survey respondents were required to complete an assent/consent form prior to entering any survey data.

Chapter 4: Results

Introduction

The aims of this study were to examine the underlying factor structure, dimensionality, internal consistency, and internal reliability of a multi-item PBS scale while also examining critical gender and racial influences on the PBS sub-scales. An additional aim of the study was to examine the relationship, or construct validity, between the PBS sub-scales with specific predictors (self-efficacy, expectations) and outcomes of interest (alcohol use, negative effects) (*construct validity analyses*). This chapter describes the results of this study including a description of the study participants, univariate results (mean, standard deviation, range) for the variables of interest (PBS items, refusal self-efficacy, protection self-efficacy, drunkenness avoidance self-efficacy, alcohol abstinence expectations, alcohol use, and negative alcohol effects), factor analytic results to identify the underlying dimensionality of the PBS sub-scales, reliability analysis of the PBS sub-scales, and validity results from correlation analysis between the PBS sub-scales and the variables of interest.

Missing Data

Follow-up survey #1

Thirteen cases were systematically missing sections of PBS responses. These cases were either missing responses for the entire section that only drinkers responded to or the section in which all students responded. Because of the systematic nature of the missing data per individual case, these thirteen cases were completely deleted from the sample. The thirteen cases which were deleted included 7 females, 13 new freshmen, 7 non

living-learning members, 10 white students, and 5 each in the mixed gender and control study conditions (Table 4.1). Ten unique cases were missing data for one PBS item per respective case. Because the missing data were not systematic by item or case, those missing data for the 10 responses were replaced with the mean of the rest of the item responses in all analyses utilizing the item-mean substitution method (IMS). SPSS was capable of handing such missing data with this specific technique.

Table 4.1. Missing Cases: Characteristics and Action Taken FU1

Gender	New Freshman	Age	LL member	Race	Condition	Action
Female	yes	18	LL	White	single	Delete case
Female	yes	18	LL	Non	control	Delete case
Male	yes	18	Non	Non	control	Delete case
Female	yes	18	LL	Non	mixed	Delete case
Male	yes	18	LL	White	mixed	Delete case
Female	yes	18	Non	White	control	Delete case
Female	yes	18	Non	White	single	Delete case
Male	yes	19+	Non	White	single	Delete case
Male	yes	18	Non	White	mixed	Delete case
Male	yes	18	Non	White	mixed	Delete case
Female	yes	17	Non	White	mixed	Delete case
Female	yes	18	LL	White	control	Delete case
Male	yes	18	LL	White	control	Delete case

Follow-up survey #2

The FU2 data were used only for examining the test-retest reliability of the PBS sub-scales. Furthermore, only those students assigned to the control group were included in the test-retest analysis. Twenty-two cases were systematically missing sections of PBS responses. These cases were either missing responses for the entire section that only drinkers responded to or the section in which all students responded. Because of the systematic nature of the missing data per individual case, these twenty-two cases were

completely deleted from the sample. The twenty-two cases which were deleted included 15 females, 22 new freshmen, 11 living-learning members, 13 white students, and 7 each in the mixed gender and single gender study conditions (Table 4.2).

Six unique cases were missing data for one unique PBS item per respective case. Because the missing data were not systematic by item or case, those missing data for the six responses were replaced with the mean of the rest of the item responses in all analyses utilizing the item-mean substitution method (IMS). SPSS was capable of handing such missing data with this specific technique. Furthermore, two cases were missing data for two PBS items. Because these missing data were not systematic by item or case, those missing data will also be handled with utilizing the IMS method.

Table 4.2. Missing Cases: Characteristics and Action Taken FU2

Gender	New freshman	Age	LL member	Race	Condition	Action
Female	Yes	19+	Yes	White	mixed	Delete case
Female	Yes	18	No	White	control	Delete case
Female	Yes	18	Yes	White	Control	Delete case
Male	Yes	18	No	White	single	Delete case
Female	Yes	18	Yes	Non	single	Delete case
Female	Yes	19+	Yes	White	single	Delete case
Male	Yes	18	Yes	White	single	Delete case
Female	Yes	18	Yes	Non	control	Delete case
Female	Yes	18	No	Non	control	Delete case
Female	Yes	18	No	White	mixed	Delete case
Male	Yes	19+	Yes	White	mixed	Delete case
Male	Yes	18	No	Non	mixed	Delete case
Female	Yes	8	No	White	single	Delete case
Female	Yes	18	Yes	White	mixed	Delete case
Male	Yes	19+	No	Non	single	Delete case
Female	Yes	19+	No	White	control	Delete case
Female	Yes	19	No	Non	mixed	Delete case
Male	Yes	19+	Yes	Non	single	Delete case
Female	Yes	18	No	White	control	Delete case
Female	Yes	18	No	White	mixed	Delete case
Female	Yes	18	Yes	Non	mixed	Delete case
Male	Yes	19+	Yes	Non	control	Delete case

Characteristics of the Parent Study Sample

FU1 Participants vs. Non-Participants

When comparing those eligible students who did and did not respond to the first follow-up survey administered 2 months into the Fall 2006 semester (FU1), there were significant differences among participants (*n*=538) when compared to non-participants (*n*=731). Proportionately fewer males and non living-learning members completed the first follow-up survey. There were no significant differences among participants and non-participants with regards to first-time freshman status, age, and race (Table 4.3).

Table 4.3. Characteristics of Participants vs. Non-Participants (all students) FU1

	Non-Participants	Participants	χ^2 (*p* value)
Gender			
Male	413 (56.5%)	221 (41.1%)	29.48 (< .001)
Female	318 (43.5%)	317 (58.9%)	
First-time freshman			
Yes	662 (90.6%)	496 (92.2%)	1.04 (.309)
No	69 (9.4%)	42 (7.8%)	
Age			
17	76 (10.4%)	56 (10.4%)	1.77 (.413)
18	545 (74.6%)	415 (77,1%)	
19+	110 (15.0%)	67 (12.5%)	
Living-Learning member			
Yes	288 (39.4%)	357 (66.4%)	90.12 (< .001)
No	443 (60.6%)	181 (33.6%)	
Race			
White	406 (55.5%)	322 (59.9%)	2.36 (.125)
Non-White	325 (44.5%)	216 (40.1%)	
Study Condition			
Control	228 (31.2%)	195 (36.2%)	4.09 (.129)
Single gender	257 (35.2%)	184 (34.2%)	
Mixed gender	246 (33.7%)	159 (29.6%)	

Participants were majority female (*n*=317, 58.9%), first-time freshmen (*n*=496, 92.2%), 18 years of age (*n*=415, 77.1%), living-learning members (*n*=357, 66.4%), and white (*n*=322, 59.9%).

FU2 Control Group Participants vs. Non-Participants

Those students assigned to the control group were utilized for the test-retest reliability analysis. Because of the parent study's aims to evaluate the effectiveness of a series of three workshops on the alcohol-related outcomes, only those data from those self-reported drinking students assigned to the control conditions at FU1 and FU2 was used to asses test-retest reliability for each sub-scale identified from factor analysis and psychometric testing due to possible parent study intervention effects in the changes in behavior. When comparing those students in the control group who did and did not respond to the second follow-up survey administered 6 months into the 2006-2007 academic year (and one month into the spring semester) (FU2), there were significant differences among participants (n=162) when compared to non-participants (n=213). Proportionately fewer males and non living-learning members completed the second follow-up survey. There were no significant differences among participants and non-participants in the control group with regards to first-time freshman status, age, and race (Table 4.4).

Table 4.4. Characteristics of Participants vs. Non-Participants FU2 Control Group Only

	Non-Participants	Participants	χ^2 (*p* value)
Gender			
Male	123 (57.7%)	71 (43.8%)	7.14 (.008)
Female	90 (42.3%)	91 (56.2%)	
First-time freshman			
Yes	195 (91.5%)	151 (93.2%)	.36 (.551)
No	18 (8.5%)	11 (6.8%)	
Age			
17	2 (.9%)	3 (1.9%)	.66 (.717)
18	141 (66.2%)	104 (64.2%)	
19+	70 (32.9%)	55 (34.0%)	
Living-Learning member			
Yes	91 (42.7%)	103 (63.6%)	16.03 (<.001)
No	122 (57.3%)	59 (36.4%)	
Race			
White	121 (56.8%)	90 (55.6%)	.06 (.809)
Non-White	92 (43.2%)	72 (44.4%)	

Participants were majority female (*n*=91, 56.2%), first-time freshmen (*n*=151, 93.2%), 18 years of age (*n*=104, 64.2%), living-learning members (*n*=103, 63.6%), and white (*n*=90, 55.6%).

Characteristics of the Current Study Sample

FU1 Drinkers vs. Non-Drinkers

Because this was a study of the PBS utilized by college student drinkers, non-drinkers were eliminated from the FU1 study sample described above. The differences between self-reported drinkers and non-drinkers among students who completed FU1 were examined to compare the characteristics and identify if the samples were significantly different. If the samples were significantly different, the ability to generalize will be reduced. Thus it was important to show the similarities and/or differences between the study samples. Additionally, an aim of this study was to

examine the differences between gender and race on the PBS scale. Therefore, it was important to show that comparable numbers of students responded to the survey and were retained for this analysis. Three-hundred and twenty students were classified as drinkers based on their self-reported responses to the alcohol use items with the remaining 218 classified as non-drinkers. Proportionately fewer non-white non-drinkers completed the first follow-up survey (Table 4.5).

Table 4.5. Characteristics of Drinkers vs. Non-Drinkers FU1

	Non-Drinkers	Drinkers	χ^2 (*p* value)
Gender			
Male	90 (41.3%)	131 (40.9%)	.01 (.936)
Female	128 (58.7%)	189 (59.1%)	
First-time freshman			
Yes	200 (91.7%)	296 (92.5%)	.10 (.748)
No	18 (8.3%)	24 (7.5%)	
Age			
17	21 (9.6%)	35 (10.9%)	2.32 (.313)
18	175 (80.3%)	240 (75.0%)	
19+	22 (10.1%)	45 (14.1%)	
Living-Learning member			
Yes	151 (69.3%)	206 (64.4%)	1.39 (.238)
No	67 (30.7%)	114 (35.6%)	
Race			
White	103 (47.2%)	219 (68.4%)	24.22 (<.001)
Non-White	115 (52.8%)	101 (31.6%)	
Study Condition			
Control	66 (30.3%)	129 (40.3%)	5.77 (.056)
Single gender	80 (36.7%)	104 (32.5%)	
Mixed gender	72 (33.0%)	87 (27.2%)	

Drinkers were majority female (*n*=189, 59.1%), first-time freshmen (*n*=296, 92.5%), 18 years of age (*n*=240, 75.0%), living-learning members (*n*=206, 64.4%), and white (*n*=219, 68.4%).

FU2 Control Group Drinkers vs. Non-Drinkers

Because this was a study of the PBS utilized by college student drinkers, the differences between self-reported drinker status among students who completed FU2 were also examined. Ninety-six students in the control group were classified as drinkers based on their self-reported responses to the alcohol use items with the remaining 66 students in the control group were classified as non-drinkers. Proportionately fewer non-whites completed the second follow-up survey (Table 4.6).

Table 4.6. Characteristics of Drinkers vs. Non-Drinkers FU2 Control Group Only

	Non-Drinkers	Drinkers	χ^2 (*p* value)
Gender			
Male	32 (48.5%)	39 (40.6%)	.98 (.322)
Female	34 (51.5%)	57 (59.4%)	
First-time freshman			
Yes	60 (90.9%)	91 (94.8%)	.93 (.334)
No	6 (9.1%)	5 (5.2%)	
Age			
17	3 (4.5%)	0 (.0%)	4.45 (.108)
18	41 (62.1%)	63 (65.6%)	
19+	22 (33.3%)	33 (34.4%)	
Living-Learning member			
Yes	42 (63.6%)	61 (63.5%)	.00 (.990)
No	24 (36.4%)	35 (36.5%)	
Race			
White	29 (43.9%)	61 (63.5%)	6.09 (.014)
Non-White	37 (56.1%)	35 (36.5%)	

Drinkers were majority female (*n*=57, 59.4%), first-time freshmen (*n*=91, 94.8%), 18 years of age (*n*=63, 65.6%), living-learning members (*n*=61, 63.5%), and white (*n*=61, 63.5%).

Descriptives

Protective Behavioral Strategies (PBS) Items

When examining the individual item means of the PBS, the most frequently practiced strategies among the total sample were to hang out with trusted friends (mean=3.45±.79 *standard deviations*), never leave a drink unattended (mean=3.37±1.08), only drink in safe environments (mean=3.23±.93), and use public transportation services (mean=3.08±.97). The least practiced strategies among all students were drink an alcohol look-alike (mean=.69±1.07), carry around a cup but not drink any alcohol (mean=1.14±1.09), avoid situations where there was alcohol (mean=1.43±.99), and pace drinks to 1 or fewer per hour (mean=1.59±1.22). There were significant mean differences between males and females, with females practicing the strategies more frequently, regarding the following protective strategies: have a friend let you know when you've had enough (mean difference=.32; $p<.05$), pace your drinks to 1 or fewer per hour (mean difference=.51, $p<.001$), avoid drinking games (mean difference=.42, $p<.01$), only drink in safe environments (mean difference=.23, $p<.05$), refuse a drink from a stranger (mean difference=.48, $p<.001$), hang out with trusted friends (mean difference=.20, $p<.05$), carry around a cup but did not drink any alcohol (mean difference=.37, $p<.01$), and use public transportation services (mean difference=.26, $p<.01$). There were also significant mean racial differences, with non-Whites practicing the strategies more frequently, regarding the following protective strategies: alternate non-alcohol beverages and alcohol beverages (mean difference=.33, $p<.05$), determine, in advance, not to exceed a set number of drinks (mean difference=.45, $p<.01$), pace your drinks to 1 or fewer per hour (mean difference=.35, $p<.01$), avoid drinking games (mean

difference=.66, $p<.001$), stop drinking at least 1-2 hours before going home (mean difference=.46, $p<.01$), never left a drink unattended (mean difference=.28, $p<.05$), choose not to drink alcohol (mean difference=.24, $p<.05$), drink an alcohol look-alike (mean difference=.27, $p<.05$), carry around a cup but did not drink any alcohol (mean difference=.31, $p<.05$), and avoid situations where there was alcohol (mean difference=.45, $p<.001$) (Table 4.7).

Table 4.7. Mean, Standard Deviation, Number Missing of PBS Items

Item	**Total Sample** Item Mean (SD) [Number missing]	**Males** Item Mean (SD) [Number missing]	**Females** Item Mean (SD) [Number missing]	**Whites** Item Mean (SD) [Number missing]	**Non-Whites** Item Mean (SD) [Number missing]
C5. Alternate non-alcohol beverages and alcohol beverages[#]	1.81 (1.24) [2]	1.73 (1.18) [1]	1.87 (1.28) [1]	1.71 (1.17) [1]	2.04 (1.36) [1]
C6. Determine, in advance, not to exceed a set number of drinks[##]	2.24 (1.28) [0]	2.13 (1.26) [0]	2.32 (1.29) [0]	2.10 (1.26) [0]	2.55 (1.28) [0]
C7. Eat before and/or during drinking	3.01 (.96) [0]	2.89 (.96) [0]	3.08 (.95) [0]	2.99 (.93) [0]	3.04 (1.03) [0]
C8. Have a friend let you know when you've had enough*	1.74 (1.41) [1]	1.55 (1.35) [0]	1.87 (1.43) [1]	1.64 (1.37) [1]	1.95 (1.47) [0]
C9. Keep track of how many drinks you were having	2.94 (1.10) [0]	2.91 (1.11) [0]	2.97 (1.09) [0]	2.91 (1.07) [0]	3.01 (1.15) [0]
C10. Pace your drinks to 1 or fewer per hour***,[##]	1.59 (1.22) [1]	1.29 (1.20) [0]	1.80 (1.24) [1]	1.48 (1.15) [0]	1.83 (1.32) [1]
C11. Avoid drinking games**,[###]	1.73 (1.35) [1]	1.48 (1.37) [1]	1.90 (1.32) [0]	1.52 (1.29) [1]	2.18 (1.39) [0]
C12. Stop drinking at least 1-2 hours before going home[##]	1.96 (1.39) [1]	1.81 (1.41) [1]	2.06 (1.38) [0]	1.81 (1.37) [1]	2.27 (1.40) [0]
C13. Limit money spent on alcohol	2.82 (1.24) [0]	2.79 (1.28) [0]	2.83 (1.23) [0]	2.74 (1.26) [0]	2.97 (1.20) [0]
C14. Only drink in safe environments*	3.23 (.93) [1]	3.09 (1.02) [0]	3.32 (.84) [1]	3.21 (.90) [0]	3.27 (.98) [1]
C15. Make your own drinks	2.66 (1.18) [1]	2.76 (1.13) [1]	2.59 (1.20) [0]	2.72 (1.14) [1]	2.54 (1.25) [0]
C16. Avoid hard liquor or spirits	1.66 (1.16) [0]	1.67 (1.17) [0]	1.66 (1.16) [0]	1.60 (1.10) [0]	1.79 (1.28) [0]
C17. Refused a drink from a stranger***	3.04 (1.23) [1]	2.76 (1.35) [0]	3.24 (1.10) [1]	2.99 (1.24) [1]	3.16 (1.21) [0]
C18. Never left a drink unattended[#]	3.37 (1.08) [0]	3.25 (1.05) [0]	3.46 (1.09) [0]	3.28 (1.13) [0]	3.56 (.94) [0]
F5. Choose not to drink alcohol[#]	2.09 (.83) [0]	2.20 (.83) [0]	2.02 (.82) [0]	2.02 (.76) [0]	2.26 (.95) [0]
F6. Use a designated driver	2.55 (1.61) [0]	2.41 (1.70) [0]	2.64 (1.55) [0]	2.45 (1.62) [0]	2.76 (1.60) [0]
F7. Drink an alcohol look-alike[#]	.69 (1.07) [0]	.56 (1.06) [0]	.78 (1.07) [0]	.60 (.99) [0]	.87 (1.21) [0]
F8. Hang out with trusted friends*	3.45 (.79) [0]	3.33 (.87) [0]	3.53 (.73) [0]	3.44 (.75) [0]	3.47 (.88) [0]
F9. Carry around a cup but did not drink any alcohol**,[#]	1.14 (1.09) [1]	.92 (1.03) [0]	1.29 (1.11) [1]	1.04 (1.03) [1]	1.35 (1.20) [0]
F10. Use public transportation services**	3.08 (.97) [0]	2.92 (1.03) [0]	3.18 (.91) [0]	3.14 (.92) [0]	2.94 (1.07) [0]
F11. Avoid situations where there was alcohol[###]	1.43 (.99) [0]	1.40 (.92) [0]	1.44 (1.00) [0]	1.28 (.96) [0]	1.73 (.98)[0]
F12. Participate in activities that did not include alcohol	2.38 (.78) [0]	2.36 (.82) [0]	2.40 (.75) [0]	2.34 (.71) [0]	2.47 (.90) [0]

* Indicates mean differences between gender, $P < .05$
** Indicates mean differences between gender, $P < .01$
*** Indicates mean differences between gender, $P < .001$
[#] Indicates mean differences between race, $P < .05$
[##] Indicates mean differences between race, $P < .01$
[###] Indicates mean differences between race, $P < .001$
NOTE: The coded response options for each item were 0=never, 1=rarely, 2=sometimes, 3=usually, 4=always.

Drinking Refusal Self-Efficacy

The four items that related to drinking self-efficacy were summed to create a single continuous drinking refusal self-efficacy scale item with a possible range of scores from 6 to 24. The Cronbach's alpha coefficient was .89. The mean score for the total sample was 17.55±5.02 standard deviations, and the median score was 18. Thus for the total sample, these scores indicated that the overall confidence among all students in refusing alcohol in specific social situations was high (Table 4.8). When examining the absolute means of the individual drinking refusal self-efficacy items, students were more confident in their ability to refuse an alcohol drink when someone offers them a drink (mean = 4.67±1.25) and when their boy/girl friend or partner is drinking (mean = 4.42±1.42) than when they are at a party or club (mean = 4.28±1.59) or when their friends are drinking (mean = 4.22±1.43) (Table 4.8).

Protection Self-Efficacy

The nine items that related to protection self-efficacy were summed to create a single continuous protection self-efficacy scale item with a possible range of scores from 0 to 54. The Cronbach's alpha coefficient was .84. The mean score for the total sample was 31.05±6.42, and the median score was 32. Thus for the total sample, these scores indicate that the overall confidence among all students in protecting themselves against alcohol-related effects was relatively high (Table 4.8). When examining the means for the individual items, students were more confident in their ability to socialize with their wing-mates in a manner that does not include alcohol (mean = 3.82±.55), avoid driving after they've been drinking (mean = 3.80±.61), and avoid riding with a wing-mate who

had been drinking (mean = 3.69±.67) when compared to the students' confidence in drinking an alcohol look-alike (mean = 2.89±1.23), avoid drinking games (mean = 3.15±.97), and carry around a cup but not drink any alcohol (mean = 3.23±1.03) (Table 4.8).

Drunkenness Avoidance Self-Efficacy

The four items related to drunkenness avoidance self-efficacy were summed to create a single continuous drunkenness avoidance self-efficacy scale item with a possible range of scores was 5-20. The Cronbach's alpha coefficient was .79. The mean score for the total sample was 13.58±2.64, and the median score was 14 (Table 4.8). Thus for the total sample, these scores indicate that the overall confidence among all students in protecting themselves against drinking too much (to the point at which they may get 'drunk') was relatively high. When examining the individual items, students were more confident in their ability to keep track of how many drinks they were having (mean = 3.53±.7), to alternate non-alcoholic beverages and alcohol beverages (mean = 3.52±.81), and to determine, in advance, not to exceed a set number of drinks (mean = 3.47±.80) than their ability to pace their drinks to 1 or fewer per hour (mean = 3.06±1.01) (Table 4.8).

Table 4.8. Mean, Standard Deviation, Number Missing of Self-Efficacy Items

Item	Total Sample Item Mean (SD) [Number missing]
Protection Self-Efficacy*	
Avoid drinking too much	3.50 (.78) [0]
Resist pressure from a wing-mate to drink too much	3.55 (.72) [1]
Avoid being in situations where you would be encouraged to drink too much	3.45 (.79) [0]
Avoid drinking games	3.15 (.97) [0]
Drink an alcohol look-alike	2.89 (1.23) [0]
Carry around a cup but not drink any alcohol	3.23 (1.03) [0]
Socialize with my wing-mates in a manner that does not include alcohol	3.82 (.55) [1]
Avoid driving after you had been drinking	3.80 (.61) [1]
Avoid riding with a wing-mate who has been drinking	3.69 (.67) [0]
Drunkenness Avoidance Self-Efficacy*	
Alternate non-alcoholic beverages and alcoholic beverages	3.52 (.81) [0]
Determine, in advance, not to exceed a set number of drinks	3.47 (.80) [0]
Pace your drinks to 1 or fewer per hour	3.06 (1.01) [0]
Keep track of how many drinks you were having	3.53 (.74) [0]
Refusal Self-Efficacy**	
When someone offers me a drink	4.67 (1.25) [0]
When my boy/girl friend or partner is drinking	4.42 (1.42) [1]
When my friends are drinking	4.22 (1.43) [0]
When I am at a party or club	4.28 (1.59) [0]

* Coded response options for each item were 1=unconfident, 2=somewhat unconfident, 3=somewhat confident, 4=confident.
** Coded response options for each item were 1=I am very sure I could NOT resist drinking, 2=I most likely could NOT resist drinking, 3=I probably could NOT resist drinking, 4=I probably could resist drinking, 5=I most likely could resist drinking, 6=I am very sure I could resist drinking.

Alcohol Abstinence Expectations

The eight items related to alcohol abstinence expectations were summed to create a single continuous alcohol abstinence expectations scale item with a possible range of scores of 8-32 and a median score of 26. The Cronbach's alpha coefficient was .93. The mean score for the total sample was 25.62±5.60 indicating the students expected positive outcomes if they abstained from consuming alcohol (Table 4.9). When examining the individual item mean scores, it appears that students mostly expected to be friendly

(mean = 3.54±.71), energetic (mean = 3.33±.81), sociable (mean = 3.31±.79), and humorous (mean = 3.26±.81) if they abstained from consuming alcohol (Table 4.9).

Table 4.9. Mean, Standard Deviation, Number Missing of Alcohol Abstinence Expectancies

Item	Total Sample Item Mean (SD) [Number missing]
I would be outgoing	3.08 (.92) [1]
I would be humorous	3.26 (.81) [1]
It would be easy to express my feelings	3.00 (.92) [1]
I would be friendly	3.54 (.71) [2]
I would feel energetic	3.33 (.81) [1]
It would be easy to talk to people	3.09 (.90) [1]
I would be talkative	3.03 (.94) [1]
I would act sociable	3.31 (.79) [2]

Note: coded response options for each item were 1=disagree, 2=somewhat disagree, 3=somewhat agree, 4=agree.

Alcohol Use

College student drinkers also consumed beer (mean=1.73±1.28 *standard deviations*) and liquor (mean=1.77±1.18) about the same number of days during the month prior to completing the survey. Additionally, college student drinkers binged an average of 1.23 days (SD=1.15) within the prior month. As expected, the average number of drinks increased towards the end of the week with the highest consumption among self-reported drinkers occurring on Fridays (mean=2.75±1.98) and Saturdays (mean=2.85±1.98). Upon summing the daily use items to create a single index to measure weekly alcohol use (Cronbach's α of .70), the average number of drinks consumed by college student drinkers was 7.52 drinks (SD=5.66) (Table 4.10).

Table 4.10. Mean, Standard Deviation, Number Missing of Alcohol Use Items

Item	Total Sample Item Mean (SD) [Number missing]
Number drinks on Sunday*	.16 (.62) [1]
Number drinks on Monday*	.12 (.57) [1]
Number drinks on Tuesday*	.21 (.77) [1]
Number drinks on Wednesday*	.12 (.58) [2]
Number drinks on Thursday*	1.33 (1.84) [2]
Number drinks on Friday*	2.75 (1.98) [0]
Number drinks on Saturday*	2.85 (1.98) [1]
Weekly Use	7.52 (5.66) [0]
Days use beer**	1.73 (1.28) [3]
Days use liquor**	1.77 (1.18) [5]
Days use alcohol of any type**	2.28 (1.25) [8]
Days binged**	1.23 (1.15) [3]

Note: Weekly use was a summed variable of all seven daily use items.
* Coded response options were 0=no drinks, 1=one drink, 2=two drinks, 3=three drinks, 4=four drinks, 5=five or more drinks.
** Coded response options were 0=none, 1=1 or 2 days, 2=3-5 days, 3=6-9 days, 4=10-19 days, 5=20-29 days, 6=all 30 days.

Negative Alcohol Effects

The most common effects included had a hangover (mean=1.00$\pm$1.12), had memory loss or blackouts (mean=.66$\pm$.96), and becoming sick or vomiting (mean=.64$\pm$.86). The least frequent negative effects included coercing another person into being sexual (mean=.03+.16), receiving a citation or being arrested (mean=.04$\pm$.25), and damaging property (mean=.08$\pm$.38) (Table 4.11). Upon summing the 18 negative alcohol effects (possible range=0-54; Cronbach's α of .87), the mean number of negative effects experienced by college student drinkers was 5.58 (SD=5.02) (Table 4.12).

Table 4.11. Mean, Standard Deviation, Number Missing of Personal Consequences Items

Item	Total Sample Item Mean (SD) [Number missing]
Missed or performed poorly in class	.39 (.76) [0]
Was confronted by a residence hall staff member	.15 (.41) [0]
Had a hangover	1.00 (1.12) [0]
Became sick or vomited	.64 (.86) [0]
Passed out	.47 (.87) [0]
Had memory loss or blackouts	.66 (.96) [0]
Physically harmed myself or another person	.13 (.46) [3]
Caused a disturbance	.37 (.73) [0]
Damaged property	.08 (.38) [1]
Had unprotected sex	.11 (.43) [1]
Received a citation or was arrested	.04 (.25) [1]
Regretted getting sexually involved with someone	.17 (.48) [0]
Coerced another person into being sexual with me	.03 (.16) [0]
Was ashamed by my behavior	.55 (.82) [0]
Had a conflict with my roommate or another person	.20 (.49) [1]
Fell behind in my studies	.26 (.67) [0]
Regretting losing control of my senses	.32 (.66) [0]
Was late for work or school	.22 (.66) [0]

Note: Coded response options for each item were 0=none, 1=1 time, 2=2 times, 3=3 or more times.

Table 4.12. Descriptives of Key Variable Indices

Summed Index	Number Items	Possible Range of Scores	Actual Range of Scores	Mean (SD)	Median	Skewness	Cronbach's α
Weekly Alcohol Use*^	7	0-35	0-27	7.52 (5.66)	7	.59	.70
Negative Alcohol Effects^	18	0-54	0-39	5.58 (6.42)	4	1.66	.87
Protection Self-Efficacy	9	9-36	9-36	31.05 (5.02)	32	-1.23	.84
Refusal Self-Efficacy	4	6-24	3-24	17.55 (5.02)	18	-.52	.89
Drunkenness Avoidance Self-Efficacy	4	4-16	4-16	13.58 (2.64)	14	-1.14	.79
Alcohol Abstinence Expectations	8	8-32	8-32	25.62 (5.60)	26	-.74	.93

* Significant mean differences by gender ($p<.05$).
^ Significant mean differences by race ($p<.05$).

Specific Aim #1: Examine the dimensionality of the PBS scale.

To determine the underlying factor structure of the PBS items and to identify whether the 22 PBS items represent a single construct (dimension) or multiple constructs (dimensions), Principal Components Analysis (PCA) was utilized (Kachigan, 1991) with orthogonal rotations. The steps in examining the dimensionality of the PBS multi-item scale utilizing PCA included examining the inter-relationships among the variables via a correlation matrix, factor extraction, examination of the eigenvalues, examination of the percentage of variance explained, examination of the scree plot, examination of the factor loadings and communalities after orthogonally rotating the factors, comprehending the resulting factors, and naming the final included factors. Additionally, the separate factor loadings for the sub-groups were rotated onto each other (males and females; whites and non-whites) via orthogonal Procrustes rotation to examine the lack of fit within the separate groups. The results from each of these steps are explained in this section and illustrated in table format.

It was hypothesized that the PBS scale would indeed be multi-dimensional based on face validity, not based on prior factor analysis. Specifically, as illustrated in both the theoretical framework and conceptual correlational matrix, it was thought that the 22 PBS items would be grouped in three distinct factors based on the type of behavior and expected outcomes if the PBS were practiced. Those factors were preliminarily named alcohol avoidance PBS, drinking responsibly PBS, and safe environments PBS. The purpose of principal components analysis (PCA) in exploratory factor analysis is to determine the number of factors with each factor representing a similar group of

variables. Therefore, the underlying dimensionality of the PBS scale resulting from PCA is explained in detail in this chapter.

Although the steps in conducting Principal Components Analysis (PCA) are fairly straightforward (as identified above), there are still options, interpretations and decisions that are needed to create the most practically reliable and valid scale with sub-scales. PCA is further validated with reliability analyses, and the PCA results are not typically considered final until interpretable and reliable scales are created (DeVellis, 2003). Hence, the following steps were utilized to determine the most comprehensive and interpretable factor structure of the PBS items.

Correlation matrix

Correlations among the 22 PBS are illustrated in Table 4.13. The bivariate correlations were examined to assess the initial underlying relationship between the variables. Multicollinearity is indicated by highly correlated variables whereas very low correlations indicate lack of a relationship between the two respective items. However, all variables were retained for inclusion to examine the underlying factor structure utilizing Principal Components Analysis (PCA). Upon initial examination of the relationships between the PBS items, the correlations suggest that some items may not be related to other PBS items suggesting multiple factors and sub-scales. These questionable relationships were re-examined with the PCA and reliability analyses to determine the best factor structure.

Table 4.13. Pearson Product-Moment Correlation Coefficients between PBS Items

Item	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	F5	F6	F7	F8	F9	F10	F11	F12
C5		.53	.36	.27	.35	.56	.43	.40	.39	.27	.27	.32	.30	.25	.18	.21	.17	.16	.09	.35	-.05	.18
C6			.48	.40	.56	.56	.42	.44	.43	.38	.29	.34	.35	.29	.26	.15	.19	.18	.23	.07	.26	.15
C7				.36	.49	.39	.22	.27	.33	.43	.34	.31	.36	.36	.07	.12	.05	.30	.15	.11	-.00	.07
C8					.30	.42	.26	.33	.25	.19	.29	.27	.23	.16	.12	.21	.18	.16	.16	.14	.19	.12
C9						.44	.35	.35	.41	.50	.32	.29	.34	.41	.27	.18	.05	.28	.18	.04	.16	.21
C10							.59	.61	.46	.35	.26	.57	.37	.22	.35	.24	.30	.16	.40	.00	.43	.20
C11								.54	.44	.33	.18	.45	.42	.25	.43	.20	.27	.10	.36	-.02	.46	.28
C12									.42	.38	.25	.36	.35	.18	.34	.25	.30	.15	.35	-.01	.40	.29
C13										.45	.28	.38	.43	.38	.32	.14	.18	.07	.22	.01	.31	.17
C14											.36	.21	.48	.38	.31	.17	.03	.38	.13	.01	.14	.32
C15												.17	.30	.24	.09	.22	.02	.18	.12	.04	.03	.11
C16													.31	.22	.33	.12	.19	.03	.31	-.03	.33	.16
C17														.50	.22	.16	.13	.24	.19	.07	.20	.18
C18															.13	.03	.01	.18	.09	.04	.06	.09
F5																.22	.32	.24	.29	.06	.56	.57
F6																	.28	.20	.19	.17	.12	.16
F7																		-.03	.57	.05	.46	.20
F8																			.09	.28	.04	.36
F9																				.07	.50	.26
F10																					.04	.09
F11																						.45
F12																						

Factor Extraction

Extraction of each unique factor that explains a significant proportion of the total variance of all 22 items is the primary goal of PCA (Kachigan, 1991). Once the maximum variance is removed from each cluster of related variables, PCA continues to seek the next maximal proportion variance from the remaining variance-until all variance has been accounted for among all variables. The first extracted factor accounts for the largest part of the variance, the second factor accounts for less variance than the first, and so on (Kachigan, 1991). This information is illustrated by examining the eigenvalues and scree plot.

Furthermore, the individual items loading on each factor were examined both in an unrotated matrix as well as after oblique and orthogonal rotation. Both rotation

methods were utilized to allow for a clearer picture of the way the PBS items related to each other. For this study utilizing exploratory factor analysis via PCA, Varimax, Promax, and Procrustes rotation methods were utilized. Rotation of the factors works in a manner that allows the loadings to be maximized. Varimax rotation is a type of orthogonal rotation which allows for the factors to remain uncorrelated. Varimax rotation also allows for each factor to retain a small number of large loadings and a large number of small loadings. Varimax rotation simplifies interpretation such that each factor has distinct items which load highly. Promax rotation is a type of oblique rotation which allows for the factors to be correlated. Oblique rotation methods also allow for simpler interpretation by attempting to fit a target matrix as well as forcing the factor loadings to become bipolar by computing a least square fit from the solution to the target matrix (Abdi, 2003). The Procrustes rotation serves to rotate two separate samples' matrices onto each other to identify the goodness of fit and lack of fit that allows for the direct comparison of dimensionality of two distinct samples of respondents (Schönemann & Carroll, 1970).

Examination of Eigenvalues, Percentage of Variance Explained, and Factor Loadings

An eigenvalue (produced from the unrotated matrix) is representative of the percentage of variance explained (produced from the rotated matrix) by each of the factors extracted via PCA (Bryant & Yarnold, 2000). For the total sample, four factors with an eigenvalue of at least 1 were extracted. The eigenvalues ranged from 6.77 (30.78% of the variance explained) to 1.28 (5.83% of the variance explained). Four factors were extracted from the pool of 22 variables for the whole sample of drinkers

utilizing the data submitted by students at FU1. An eigenvalue of 1 was set as the cut-off point for possible inclusion for the unique factors identified via PCA (Hair et al., 1998). Upon examining the rotated factor matrices, the first factor, which included 8 variables, explained almost 31% of the total possible variance among all 22 variables. PCA continues to partial out the next set of variables (factors) that explains the most of the remaining variance. The second factor, including 8 variables, thus explained an additional 10.5% of the variance. The third factor (2 variables) explained an additional 7.2% of the variance, and the final factor (4 variables) explained 5.8% of the variance. Thus the four factors combined accounted for 54.3% of the total variance.

For the males only, five factors with an eigenvalue of at least 1 were extracted. The eigenvalues ranged from 6.17 (28.03% of the variance explained) to 1.05 (4.78% of the variance explained). Five factors were extracted from the pool of 22 variables for the male drinkers utilizing the data submitted by students at FU1. An eigenvalue of 1 was set as the cut-off point for possible inclusion for the unique factors identified via PCA (Hair et al., 1998). The first factor, which included 8 variables, explained 28.0% of the total possible variance among all 22 variables. PCA continues to partial out the next set of variables (factors) that explains the most of the remaining variance. The second factor, including 5 variables, thus explained an additional 11.4% of the variance. The third factor (4 variables) explained an additional 8.2% of the variance, the fourth factor (3 variables) explained 6.3% of the variance, and the fifth factor (2 variables) explained 4.8% of the variance. Thus the five factors combined accounted for 58.8% of the total variance.

For the females only, six factors with an eigenvalue of at least 1 were extracted. The eigenvalues ranged from 7.19 (32.68% of the variance explained) to 1.00 (4.56% of the variance explained). Six factors were extracted from the pool of 22 variables for the female drinkers utilizing the data submitted by students at FU1. An eigenvalue of 1 was set as the cut-off point for possible inclusion for the unique factors identified via PCA (Hair et al., 1998). The first factor, which included 8 variables, explained 32.7% of the total possible variance among all 22 variables. PCA continues to partial out the next set of variables (factors) that explains the most of the remaining variance. The second factor, including 4 variables, thus explained an additional 10.5% of the variance. The third factor (3 variables) explained an additional 6.9% of the variance. The fourth factor (3 variables) explained 5.8% of the variance. The fifth factor (3 variables) explained 4.7% of the variance, and the sixth factor (1 variable) explained 4.6% of the variance. Thus the six factors combined accounted for 65.08% of the total variance.

For the white drinkers only, six factors with an eigenvalue of at least 1 were extracted. The eigenvalues ranged from 6.21 (28.21% of the variance explained) to 1.06 (4.81% of the variance explained). Six factors were extracted from the pool of 22 variables for the white drinkers utilizing the data submitted by students at FU1. An eigenvalue of 1 was set as the cut-off point for possible inclusion for the unique factors identified via PCA (Hair et al., 1998). The first factor, which included 8 variables, explained 28.2% of the total possible variance among all 22 variables. PCA continues to partial out the next set of variables (factors) that explains the most of the remaining variance. The second factor, including 4 variables, thus explained an additional 10.5% of the variance. The third factor (3 variables) explained an additional 7.3% of the variance.

The fourth factor (4 variables) explained 6.3% of the variance. The fifth factor (2 variables) explained 5.3% of the variance, and the sixth factor (1 variable) explained 4.8% of the variance. Thus the six factors combined accounted for 62.39% of the total variance.

For the non-white drinkers, four factors with an eigenvalue of at least 1 were extracted. The eigenvalues ranged from 7.79 (35.40% of the variance explained) to 1.28 (5.83% of the variance explained). Four factors were extracted from the pool of 22 variables for the non-white drinkers utilizing the data submitted by students at FU1. An eigenvalue of 1 was set as the cut-off point for possible inclusion for the unique factors identified via PCA (Hair et al., 1998). The first factor, which included 6 variables, explained 35.4% of the total possible variance among all 22 variables. PCA continues to partial out the next set of variables (factors) that explains the most of the remaining variance. The second factor, including 8 variables, thus explained an additional 11.2% of the variance. The third factor (6 variables) explained an additional 7.8% of the variance, and the final factor (2 variables) explained 5.8% of the variance. Thus the four factors combined accounted for 60.3% of the total variance.

Once PCA results are obtained, reliability analyses can be utilized to further determine and make sense of the dimensionality of a scale. Two of the main elements that contribute to the internal consistency (reliability) of a scale as determined by the Cronbach's alpha coefficient method are the number of items (variables) and the inter-item correlations between the variables (Di Iorio, 2005). Increasing the number of variables in a scale/sub-scale increases the internal consistency because each item is correlated with every other item and the alpha level is computed by the average inter-item

correlations. Therefore with added items, more inter-item correlations was produced resulting in an increased average (Di Iorio, 2005). Because the internal consistency of a scale/sub-scale represents the degree to which the items that make up a scale are inter-correlated (Clark & Watson, 1995), there must be multiple items that make up the scale. Therefore there must be at least 2 variables that comprise a single factor. Because some of the factors generated via the initial factor analysis included only one, two or three variables and the small number of variables could result in less than desirable internal consistency (defined as a Cronbach's alpha coefficient of less than .70), the factor loadings were examined to determine if the small factors (with 3 or fewer variables) made sense and if those factors which did not account for a significant proportion of the variance should be retained or combined with other factors. When determining the final scale structure, it was important to consider not only the results from PCA but also the results from the reliability analysis. Therefore, the final scale structure for all derivations of the sample was determined by not only examining the PCA results but also examining the reliability results.

Additionally, the factor structure of each sub-sample (males, females; whites, non-whites) cannot be compared directly to each other simply by examining the PCA outcomes. According to Schönemann & Carroll (1970), "before a meaningful comparison could be made, it would be necessary to rotate, translate, and stretch or shrink the nonmetric scaling configuration so as to obtain maximal agreement with the factor solution". The Procrustes orthogonal rotation method thus allows for rotation of a given matrix A onto another given matrix B and allows for the matrices of different samples to be directly compared.

This rotation method allowed for each of the unique factor loadings from each sample to be directly compared and produces a matrix of best fit, a residual matrix (or matrix of least fit), and a coefficient of non-determination. A coefficient of non-determination is $1 - R^2$, where R^2 represents the coefficient of determination. Thus the coefficient of non-determination is a measure of the percent of variance *not* explained by the items (Hair, 1998). While there are no standards to acceptable coefficients of non-determination, a coefficient of non-determination of less than .20 has been identified as acceptable for this study. The rationale is that if the coefficient of non-determination is less than .20, the coefficient of determination is at least .80. The residual matrix can be interpreted to identify items which do not have the best of 'fit' with the other items when the matrices are rotated onto each other. In other words, when examining the sub-group influence on the factors, some items may have large discrepancies. This lack of fit can be determined by examining the average squared error for each value (represented by `(TR(E'E)/PQ).` Any item which has a value in the residual matrix that is approaching twice the square root of this average error indicates an item which does not fit well for the rotated matrix across the samples.

Because the results of the preliminary PCA were different across all five samples (total samples, males, females, whites, non-whites), it was helpful to further explore the 'fit' of the sub-sample matrices relative to each other. To accomplish this, PCA was re-run with each of the sub-samples (males, females, whites, non-whites) forcing the maximum number of factors. Because PCA for females and whites suggested a six-factor solution, six factors were forced for all four sub-samples because Procrustes rotation methods rotate the matrix for each sample onto each other and there needed to be an

equal number of factors. The initial factor loadings were then retained and utilized to rotate the male and female factor loadings onto each other and the white and non-white factor loadings onto each other.

The results from this initial Procrustes rotation with the factor loadings forcing six factors suggested that the goodness of fit fell after the first four factors suggesting a four-factor solution. Additionally the coefficients of non-determination were fairly high suggesting that the variance explained by the factors could be improved upon by either removing items which have considerable discrepancy between the samples or by limiting the number of factors. Based on the combined output of PCA, the residual matrix, the coefficients of non-determination, and preliminary reliability analyses for the six factor solution, a four-factor solution was forced for each sub-sample and Procrustes rotation was re-run with the initial factor loadings. Therefore, a 4-factor solution was forced via factor analysis stipulating that 4 factors were extracted rather than utilizing the eigenvalue criterion of at least 1.00 (Table 4.14). The initial factor loadings were again orthogonally rotated via Procrustes rotation again. Subsequently, coefficients of non-determination were still high (Table 4.15), and the Cronbach's alpha coefficients were low for some of the factors and therefore did not support a four-factor solution (Table 4.16).

Table 4.14. Rotated Factor Loadings based on Forced 4-Factor Structure of PBS Items, Total Sample

	Component			
	1	2	3	4
C5 Alternate non-alcoholic beverages and alcoholic beverages	.461	**.530**	-.068	.068
C6 Determine, in advance, not to exceed a set number of drinks	**.611**	.423	-.049	.162
C7 Eat before and/or during drinking	**.682**	.087	-.162	.302
C8 Have a friend let you know when you've had enough	.341	.359	-.195	**.428**
C9 Keep track of how many drinks you were having	**.702**	.154	.104	.128
C10 Pace your drinks to 1 or fewer per hour	.487	**.670**	.021	.074
C11 avoid drinking games	.412	**.570**	.288	-.100
C12 Stop drinking at least 1-2 hours before going home	.386	**.567**	.191	.078
C13 Limit money spent on alcohol	**.600**	.349	.145	-.153
C14 Only drink in safe environments	**.692**	-.004	.365	.127
C15 Make your own drinks	**.504**	.093	-.148	.284
C16 Avoid hard liquor or spirits	.380	**.509**	.051	-.172
C17 Refused a drink from a stranger	**.645**	.146	.205	-.023
C18 Never left a drink unattended	**.667**	-.061	.121	-.114
F5 Choose not to drink alcohol	.128	.424	**.706**	.009
F6 Use a designated driver	.049	.305	.081	**.519**
F7 Drink an alcohol look-alike (non-alcoholic beer, etc)	-.132	**.703**	.103	.158
F8 Hang out with trusted friends	.332	-.196	.399	**.551**
F9 Carry around a cup but did not drink any alcohol	.023	**.704**	.115	.115
F10 Use public transportation services	-.031	-.051	.074	**.628**
F11 Avoid situations where there was alcohol	.008	**.699**	.449	-.052
F12 Participate in activities that did not include alcohol	.101	.200	**.757**	.194

Table 4.15. Residual Matrix and Coefficients of Non-Determination for Forced 4-Factor Solution

Gender

	1	2	3	4
C5	.0395	-.0567	.2720	-.1457
C6	-.1188	-.0603	-.0461	-.0730
C7	-.0320	-.1207	-.0500	-.0321
C8	-.1442	.0625	-.2558	-.3323
C9	.1379	.0561	-.1046	.2076
C10	.0422	.0923	.0274	-.1808
C11	-.0526	-.0620	.1483	-.0877
C12	.1144	.2486	-.1294	-.0743
C13	-.0039	.0002	.0164	.1282
C14	.0411	-.0744	.0120	.1366
C15	.0575	-.1285	.1871	-.0479
C16	.0315	-.0722	-.0135	-.1590
C17	-.0460	.2289	-.1631	.0168
C18	.0217	-.0318	-.0287	.2460
F5	.0578	-.0189	-.0691	.0630
F6	-.0247	.0819	.1064	.2040
F7	-.0855	-.0143	-.1574	.3465
F8	.0297	-.0180	.1256	-.0321
F9	.0440	-.1101	.0399	.2425
F10	-.0281	-.0047	.0098	-.1910
F11	.0021	-.0268	-.0372	-.1509
F12	-.0834	.0288	.1100	-.0842

TR(E'E)/PQ = .0146; SYMMETRIC COEFFICIENT OF NON-DETERMINATION S = .2252

Race

	1	2	3	4
C5	-.0578	-.2127	-.2155	-.3157
C6	.0864	-.0047	-.0170	-.2161
C7	.1548	-.0789	-.1683	-.1382
C8	-.0152	.0083	-.1268	.3202
C9	.0232	.0345	.0121	-.0855
C10	.0410	-.1550	.0476	.1321
C11	-.0993	-.0488	.0261	-.0625
C12	-.1060	.0411	.0700	.2747
C13	-.0077	-.0165	.0809	.0618
C14	-.0303	-.1357	-.1150	-.1540
C15	-.1200	-.1958	-.4323	.0284
C16	.2329	-.1172	-.1558	.2256
C17	.0724	.1574	.2293	.1206
C18	.1743	.0947	.3522	.0767
F5	-.0969	-.1402	-.0804	-.0048
F6	.1981	.0639	.2656	-.2700
F7	.0050	.2448	.2383	-.0236
F8	-.0039	.0475	-.1070	-.1955
F9	.0190	.1677	.0862	-.1603
F10	-.1918	.2975	.2276	.1629
F11	-.0247	-.0229	-.1045	.1053
F12	-.2532	-.0287	-.1134	.1178

TR(E'E)/PQ = .0239, SYMMETRIC COEFFICIENT OF NON-DETERMINATION S = .3432

Table 4.16. Reliability Based on 4-Factor Solution

Sample	Factor 1 (8 items)	Factor 2 (8 items)	Factor 3 (2 items)	Factor 4 (4 items)
Total	.833	.844	.718	.432
Males	.822	.809	.814	.383
Females	.840	.861	.644	.441
Whites	.804	.838	.684	.403
Non-whites	.881	.838	.757	.491

Note: Factor 3 included the following items: "choose not to drink alcohol" & "participate in activities that did not include alcohol". Factor 4 included the following items: "have a friend let you know when you've had enough to drink"," use a designated driver"," hang out with trusted friends", "use public transportation services".

Five items were subsequently deleted based on a number of inter-related decisions. Specific items exhibited lack of fit either between PBS items or between the sub-samples upon closer examination of the original correlation matrix of the 22 PBS items, low factor loadings and/or high cross-loadings, the residual matrix, reliability analysis, and the potential interpretability of subsequent factors. Because some items were not asked of students in the context of being in alcohol-related situations, some items can be performed without being in the presence of alcohol and could therefore not be directly considered alcohol protection behaviors for this sample of students. Those five deleted items were "*choose not to drink alcohol", "use a designated driver", "hang out with trusted friends", "use public transportation services", and "participate in activities that did not include alcohol"*. Even though these items were frequently endorsed, the five items were not associated with the other variables as evidenced by the correlation matrix, the factor loadings, and the residual matrices. It was important to consider what may be lost by deleting these items. Because these items were frequently endorsed, these items may have had a significant impact on the scale structure of the overall PBS scale. By deleting these five items, the factor structure may have been different than if the items were retained. It was also plausible that the factor structure

may not have supported retaining these five items because of the frequency with which the items were endorsed or the difference by which these items were endorsed by the different sub-samples. However, a goal of this study was to find the best scale structure for all samples, so the five items were deleted to try to find the most parsimonious scale structure for all samples.

The remaining 17 items were then factor analyzed again with the total sample. A three-factor structure was supported based on the initial PCA methodology with the total sample: an eigenvalue cut-off level of 1.00 (*not* a forced three-factor model). Based on the factor structure of the total sample, each of the sub-groups were then forced into a 3-factor structure (Table 4.17), and the factor loadings for each of the four sub-samples were utilized for repeated orthogonal rotation utilizing Procrustes rotations. The residual matrix was more favorable for the 3-factor solution when compared to the four-factor solution (Table 4.18). However, the coefficients of non-determination for the whites and non-whites were not as strong as possible suggesting a significant proportion of the variance of the scale was still not accounted for (Table 4.18). Reliability analysis was also utilized to examine the internal consistency of the three factors resulting in borderline acceptable alpha coefficients and small item-total correlations among certain PBS items (Table 4.19).

Table 4.17. Rotated Factor Loadings based on 3-Factor Structure of PBS Items, Total Sample

	Component		
	1	2	3
C5 Alternate non-alcoholic beverages and alcoholic beverages	.425	**.573**	.144
C6 Determine, in advance, not to exceed a set number of drinks	.321	**.651**	.290
C7 Eat before and/or during drinking	-.033	**.689**	.339
C8 Have a friend let you know when you've had enough	.202	**.665**	-.027
C9 Keep track of how many drinks you were having	.103	**.538**	.501
C10 Pace your drinks to 1 or fewer per hour	**.606**	.532	.225
C11 avoid drinking games	**.623**	.196	.406
C12 Stop drinking at least 1-2 hours before going home	**.572**	.356	.260
C13 Limit money spent on alcohol	.351	.242	**.596**
C14 Only drink in safe environments	.060	.334	**.662**
C15 Make your own drinks	-.053	**.579**	.234
C16 Avoid hard liquor or spirits	**.476**	.268	.267
C17 Refused a drink from a stranger	.208	.139	**.750**
C18 Never left a drink unattended	-.017	.108	**.766**
F7 Drink an alcohol look-alike (non-alcoholic beer, etc)	**.720**	-.007	-.065
F9 Carry around a cup but did not drink any alcohol	**.735**	.106	.009
F11 Avoid situations where there was alcohol	**.800**	-.016	.103

Table 4.18. Residual Matrix and Coefficients of Non-Determination for 3-Factor Solution

Gender

	1	2	3
C5	.0577	.0525	-.0938
C6	-.0916	.0504	-.1370
C7	-.0062	.0758	.0190
C8	-.0608	-.1364	.3697
C9	.1168	-.0204	-.1399
C10	.0622	-.1395	.0012
C11	-.0920	.0718	.1572
C12	.1173	-.2455	-.1213
C13	-.0263	.0533	-.0620
C14	-.0148	.0982	-.1285
C15	.0851	.1157	.1568
C16	.0300	.0763	-.0241
C17	-.0481	-.2221	.0622
C18	-.0291	.0230	.0069
F7	-.0952	.0161	-.1045
F9	.0242	.1239	.0161
F11	-.0292	.0066	.0221

TR(E'E)/PQ = .0113; SYMMETRIC COEFFICIENT OF NON-DETERMINATION S = .1717

Race

	1	2	3
C5	-.0630	-.1360	-.0897
C6	.0258	-.0264	-.2117
C7	.1309	.0268	-.1401
C8	-.0310	.1063	.1967
C9	.0114	.0386	-.1744
C10	.0067	-.1820	.1027
C11	-.0731	-.0882	-.0847
C12	-.0808	.0299	.0615
C13	-.0647	-.0798	.1107
C14	.1263	.0165	-.3751
C15	-.0644	.0550	.2248
C16	.2103	-.1011	.3849
C17	-.0495	.0560	.1748
C18	.0169	-.0591	.0971
F7	-.1381	.1532	-.0798
F9	-.0627	.1586	-.2006
F11	.0991	.0317	.0030

TR(E'E)/PQ = .0175; SYMMETRIC COEFFICIENT OF NON-DETERMINATION S = .2429

Table 4.19. Reliability Based on 3-Factor Solution

Sample	Factor 1 (7 items)	Factor 2 (6 items)	Factor 3 (4 items)
Total	.831	.773	.751
Males	.801	.739	.764
Females	.845	.793	.734
Whites	.818	.768	.699
Non-whites	.835	.783	.843

Based on the weak support for a three-factor structure based on the analyses (especially the high factor cross-loadings for some items, the low Cronbach's alpha for factor 3 among the whites, and the relative high coefficients of non-determination for the whites/non-whites) of the 17 PBS items, a two-factor solution was forced via factor analysis with the total sample. The remaining 17 items for each of the four sub-samples were also forced into two factors with the initial factor loadings utilized for orthogonal Procrustes rotations. The residual matrix was improved upon (when compared with the 6-, 5-, 4-, and 3-factor structures with all 22 items as well as compared to the 3-factor

structure with 17 items) (Table 4.21). The coefficients of non-determination were also improved upon with the males and females resulting in a .1338 and the whites and non-whites resulting in a .1397. These coefficients of non-determination indicated that less than 15% of the factors' variance was not accounted for by the rotation of the factor loadings for the sub-samples. Reliability analysis (explained later) also supported a two-factor solution with high Cronbach's alpha coefficients and high item-total correlations. (Table 4.27) Therefore, while a three-factor solution was acceptable, a two-factor solution was optimal and thus was retained for the remaining analyses.

The residual matrix and coefficients of non-determination supported a two-factor solution. An examination of the factor loadings for the forced two-factor solution also indicated that the two-factor solution was acceptable (Table 4.22). No single PBS item had high cross-loadings ($\geq$ .40) on the two factors, and each PBS item had high factor loadings on only one factor ($\geq$ .40).

Final Factor Structure

Table 4.20. Eigenvalues* with Percent Variance Explained of PBS Items, Total Sample**

Factor	Eigenvalue	% of Variance Explained	Cumulative %
1	6.229	36.643	36.643
2	2.046	12.035	48.678
3	1.105	6.500	55.178

* Eigenvalues produced before factor rotation.
** Percent Variance Explained produced after factor rotation.

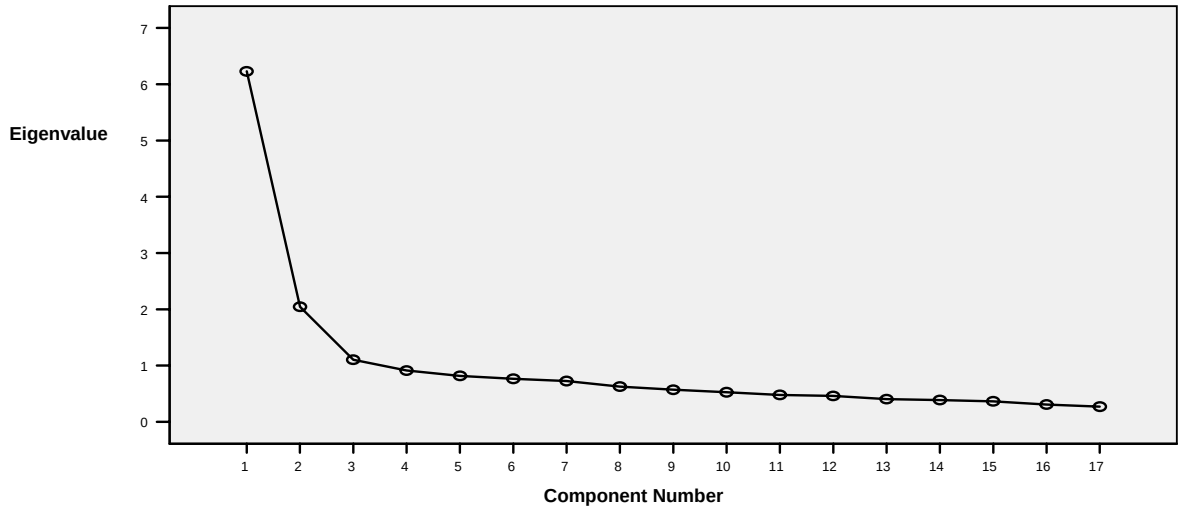

Figure 4.1. Scree Plot Illustration of Eigenvalues, Total Sample

Table 4.21. Residual Matrix Factor Loadings for Forced 2-Factor Solution

	Males/Females		Whites/Non-Whites	
PBS Item	**Factor 1**	**Factor 2**	**Factor 1**	**Factor 2**
C5	.0766	.0631	-.1199	-.1307
C6	-.0740	.0603	-.0405	-.0205
C7	.0214	.0914	.0658	.0331
C8	-.0056	-.1053	-.1092	.1144
C9	.1142	-.0217	-.0156	.0406
C10	.0764	-.1317	-.0226	-.1798
C11	-.1024	.0658	-.0424	-.0917
C12	.1131	-.2480	-.0859	.0300
C13	-.0526	.0385	-.0019	-.0867
C14	-.0368	.0860	.1259	.0163
C15	.1120	.1310	-.0977	.0584
C16	.0224	.0721	.2606	-.1054
C17	-.0799	-.2399	.0428	.0463
C18	-.0668	.0021	.1158	-.0687
F7	-.1003	.0132	-.1350	.1543
F9	.0264	.1251	-.0727	.1605
F11	-.0440	-.0019	.1324	.0296

Note: Males and females were compared in a single Procrustes rotation then whites and non-whites were compared in a separate Procrustes rotation.
Males/Females: TR(E'E)/PQ = .0091; Coefficient of Non-Determination: .1338
Whites/Non-whites: TR(E'E)/PQ = .0102; Coefficient of Non-Determination: .1397

Table 4.22. Factor Structure: PBS rotated factor loadings, FU1 Total Sample

Item	Promax Rotated Factor Loadings	
	1	2
C5. Alternate non-alcohol beverages and alcohol beverages	.364	**.416**
C6. Determine, in advance, not to exceed a set number of drinks	**.579**	.260
C7. Eat before and/or during drinking	**.780**	-.152
C8. Have a friend let you know when you've had enough	**.372**	.202
C9. Keep track of how many drinks you were having	**.756**	-.030
C10. Pace your drinks to 1 or fewer per hour	.333	**.603**
C11. Avoid drinking games	.237	**.596**
C12. Stop drinking at least 1-2 hours before going home	.249	**.565**
C13. Limit money spent on alcohol	**.530**	.242
C14. Only drink in safe environments	**.760**	-.106
C15. Make your own drinks	**.623**	-.143
C16. Avoid hard liquor or spirits	.230	**.459**
C17. Refused a drink from a stranger	**.637**	.049
C18. Never left a drink unattended	**.714**	-.206
F7. Drink an alcohol look-alike	-.332	**.827**
F9. Carry around a cup but did not drink any alcohol	-.197	**.820**
F11. Avoid situations where there was alcohol	-.230	**.877**

Comprehension and Naming of Factors

Upon examination of the group of PBS items which comprised the final two factors, Factor 1 was named the 'Planning' PBS while the second factor was named the 'Execution' PBS. 'Planning' PBS was utilized for the nine items which dealt with have to think about drinking prior to or during consumption. For example, determining not to exceed a set number of drinks or keeping track of the number of drinks requires some cognition before or during drinking. 'Execution' PBS was utilized for the eight items that dealt with the manner in which students socialized or partied. For example, alternating non-alcoholic and alcoholic drinks is a 'way' to drink, and pacing the number of drinks per hour requires a behavior not just a cognition. While not all items that loaded on the Planning PBS sub-scale occur prior to drinking, this was the most

comprehensive and logical name. The same can be said for justifying naming the second sub-scale 'Execution' PBS.

Specific Aim 2: Examine the internal consistency and test-retest reliability of the PBS sub-scales.

To examine the internal consistency of the PBS sub-scales and to help verify the dimensionality of the PBS sub-scales, Cronbach's alpha coefficients were computed for each of the PBS sub-scales. Sub-scale and descriptive statistics for the sample of college student drinkers are presented in Tables 4.23-4.26. The reliability coefficients for the sub-scales were acceptable for all sub-scales when examining the total sample and each of the sub-samples (gender, race) (Table 4.27).

Table 4.23. Item Statistics for Total Sample, Planning PBS

	Mean	Std. Deviation	*N*
Determine, in advance, not to exceed a set number of drinks	2.2373	1.28137	316
Eat before and/or during drinking	3.0000	.96280	316
Have a friend let you know when you've had enough	1.7405	1.40828	316
Keep track of how many drinks you were having	2.9430	1.09975	316
Limit money spent on alcohol	2.8259	1.23626	316
Only drink in safe environments	3.2342	.92009	316
Make your own drinks	2.6646	1.17709	316
Refuse a drink from a stranger	3.0380	1.23384	316
Never leave a drink unattended	3.3703	1.08625	316

Table 4.24. Item-Total Statistics for Total Sample, Planning PBS

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's α if Item Deleted
Determine, in advance, not to exceed a set number of drinks	22.8165	35.636	.610	.803
Eat before and/or during drinking	22.0538	38.527	.598	.808
Have a friend let you know when you've had enough	23.3133	37.644	.404	.832
Keep track of how many drinks you were having	22.1108	36.943	.632	.802
Limit money spent on alcohol	22.2278	36.748	.556	.810
Only drink in safe environments	21.8196	38.942	.593	.809
Make your own drinks	22.3892	38.689	.446	.823
Refused a drink from a stranger	22.0158	36.695	.561	.810
Never left a drink unattended	21.6835	38.623	.504	.816

Table 4.25. Item Statistics for Total Sample, Execution PBS

	Mean	Std. Deviation	*N*
Alternate non-alcoholic beverages and alcoholic beverages	1.8248	1.24013	314
Pace your drinks to 1 or fewer per hour	1.5828	1.21801	314
Avoid drinking games	1.7134	1.34972	314
Stop drinking at least 1-2 hours before going home	1.9363	1.38768	314
Avoid hard liquor or spirits	1.6433	1.15293	314
Drink an alcohol look-alike (non-alcoholic beer, etc)	.6752	1.05876	314
Carry around a cup but did not drink any alcohol	1.1274	1.07380	314
Avoid situations where there was alcohol	1.4140	.97930	314

Table 4.26. Item-Total Statistics for Total Sample, Execution PBS

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach' α if Item Deleted
Alternate non-alcoholic beverages and alcoholic beverages	10.0924	33.975	.544	.830
Pace your drinks to 1 or fewer per hour	10.3344	31.770	.738	.805
Avoid drinking games	10.2038	31.626	.654	.816
Stop drinking at least 1-2 hours before going home	9.9809	31.878	.611	.822
Avoid hard liquor or spirits	10.2739	35.145	.505	.835
Drink an alcohol look-alike (non-alcoholic beer, etc)	11.2420	36.574	.444	.841
Carry around a cup but did not drink any alcohol	10.7898	35.099	.560	.828
Avoid situations where there was alcohol	10.5032	35.542	.589	.826

Table 4.27. Cronbach's Alpha Coefficient for all Sub-Samples

Sample	Planning	Execution
Total	.830	.844
Males	.816	.809
Females	.839	.861
Whites	.806	.838
Non-whites	.869	.838

Because longitudinal data were available, the test-retest reliability (or stability) of the PBS sub-scales for the total sample was examined utilizing data from self-reported college student drinkers in the control condition at both follow-up times. Test-retest reliability is a good indicator of the stability of the items because it was the same data collected at two or more time points. Follow-up #1 data were collected 2 months into the fall semester while follow-up #2 data were collected 5 months after the first follow-up data (and one month into the spring semester). Those students in the control condition were included for this analysis due to the potential confounding effect of the parent study's intervention. To examine test-retest reliability, the summed scores for each of the PBS sub-scales at FU1 were correlated with the respective summed scores for the PBS sub-scales at FU2 to produce a Pearson product moment correlation coefficient. This correlation indicates the relationship between the two sets of data. A correlation coefficient of .90 is typically deemed as acceptable based on the interpretation that less than 20% of the variance is unaccounted for. The test-retest reliability was examined with a sample of 96 students in the control condition whom completed both the FU1 and FU2 surveys. The correlation coefficient for factor 1 was .410 and for factor 2 was .509. While these correlation coefficients are less than the .90 level as recommended by Kachigan (1991), each of the test-retest correlation coefficients are above the acceptable

Pearson-product moment correlation coefficient level of .40 (Di Iorio, 2005) suggesting that the PBS sub-scales exhibit acceptable test-retest reliability. These low test-retest correlations may be due to the extended amount of time that elapsed between FU1 and FU2 as well as the change of wording of the lead-in statement for the PBS items in FU2.

Specific Aim 3: Examine the construct validity of the PBS sub-scales.

Once the two PBS sub-scales were created through dimensionality analyses and the internal consistency was verified, the items comprising the PBS sub-scales were summed to create a single PBS sub-scale score. Nine items comprised the 'Planning' PBS sub-scale. The possible and observed range of scores was 0-36 with a mean score for the total sample of 25.02$\pm$6.82. A possible ceiling effect may have occurred with the Planning PBS sub-scale because of the high mean scores indicating that most students frequently endorsed those nine Planning PBS sub-scale items. Eight items comprised the 'Execution' sub-scale. The possible and observed range of scores was 0-32 with a mean score for the total sample of 11.97$\pm$6.57. A one-way analysis of variance was utilized to examine the mean differences of each PBS sub-scale for males and females as well as for whites and non-whites. Significant mean differences existed between males and females for both PBS sub-scales, and significant mean differences existed between whites and non-whites for the 'Execution' PBS sub-scale (Table 4.28). However, there were no mean differences for either PBS sub-scales among living-learning members and non-members as well as for students in the different study conditions.

Table 4.28. Mean Differences in the Summed PBS Sub-Scales Scores, Mean (SD); FU1

	Planning PBS	Execution PBS
Total Sample	25.02 (6.82)	11.97 (6.57)
Males	24.11 (6.73)	10.82 (6.09)
Females	25.65 (6.84)*	12.77 (6.78)*
Whites	24.55 (6.50)	11.03 (6.20)
Non-Whites	26.03 (7.41)	14.02 (6.89)*
Living-Learning Members	25.34 (6.91)	11.67 (6.67)
Non Living-Learning Members	24.44 (6.65)	12.51 (6.38)
Single Condition	24.91 (7.11)	11.34 (6.38)
Mixed Condition	25.69 (6.20)	12.21 (6.39)
Control Condition	24.65 (7.01)	12.33 (6.84)

* Indicates significant mean differences between groups (p<.05).

It was originally hypothesized that the PCA for the 22 PBS items would result in three distinct factors thus suggesting a multidimensional scale. While the three-factor solution was not strongly supported, a two-factor solution was supported thus resulting in a bi-dimensional scale with each of the sub-scales having confirmed adequate reliability. Because the 22 PBS items did not result in the hypothesized sub-scales, Figure 4.2 represents the expected relationships between the actual PBS sub-scales and the alcohol-related variables of interest.

	Planning PBS	Execution PBS
Planning PBS		**R**
Execution PBS	**R**	
Alcohol abstinence expectations	**R**	**X**
Refusal self-efficacy	**R**	**R**
Protection self-efficacy	**R**	**R**
Drunkenness avoidance self-efficacy	**R**	**R**
Days use beer	**R**	**R**
Days use liquor	**R**	**R**
Days use alcohol of any type	**R**	**R**
Days binge	**R**	**R**
Weekly use	**R**	**R**
Negative alcohol effects	**R**	**R**

Figure 4.2: Revised Correlation Matrix Identifying Expected Relationships

R indicates expected significant relationship (convergent validity).
X indicates no expected significant relationship (discriminant validity).

Another important component of scale development is the determination of the construct validity of the sub-scales. It was expected that the distinct PBS sub-scales was related to different predictors and outcomes. The correlations of the sub-scales with each other as well as with the predictors and outcomes were examined to assess the degree of convergence and discrimination. The relationship between the two PBS sub-scales was examined by the part and partial correlations. A minimum correlation of .40 in the expected direction was used to support the convergent validity of the variables. The gender and race sub-samples were not used in the examination of validity because sub-scales had been created via PCA and Procrustes rotation methods that are compatible for all samples. Rather, gender and race (as well as study condition and living-learning membership) were controlled for and the correlation coefficients were reported. For each

set of variables for which convergent validity was tested (ie: Planning PBS and alcohol abstinence expectations), each variable along with study condition, living-learning membership, gender and race were entered into a multiple linear regression model. Multiple linear regression analysis was preferred over a standard correlation matrix so that the covariates were accounted for when examining the relationships between the variables of interest. Thus, the correlation reflected the relationship between the two variables after accounting for the effect of study condition, living-learning membership, gender and race.

It must be reiterated, however, that the purpose of examining the validity of the variables was not to identify the most parsimonious predictive model of the outcomes. Rather, the purpose was to examine the PBS items as both predictors and outcomes and to interpret convergent and discriminant validity from these relationships. Therefore, in addition to examining the relationship between the two sub-scales, the part and partial correlations (controlling for study condition, living-learning membership, gender and race) were used to examine the relationships between the PBS sub-scales and alcohol abstinence expectations, refusal self-efficacy, protection self-efficacy, and drunkenness avoidance self-efficacy as hypothesized predictors of PBS. Additionally, the part and partial correlations (again controlling for study condition, living-learning membership, gender and race) were used to examine the relationships between the PBS sub-scales and days use beer, days use liquor, days use alcohol of any type, days binge, and number of negative alcohol effects as hypothesized outcomes influenced by PBS.

The two PBS sub-scales exhibited high, significant inter-item correlation coefficients ($R = .586$, $p<.001$) suggesting convergent validity between the sub-scales.

This high correlation between the sub-scales suggests that these sub-scales are in fact related and measure two dimensions of the same construct (protective behaviors) rather than measuring two distinct constructs. Table 4.29 shows the relationships between the PBS sub-scales with the hypothesized outcomes and predictors (accounting for the covariates). The 'Execution' PBS sub-scale shows high, significant relationships with all other variables except alcohol abstinence expectations, suggesting that the Execution PBS sub-scale does in fact converge on refusal, protection and drunkenness avoidance self-efficacy as well as all alcohol use behaviors. The correlations between Planning PBS and alcohol abstinence expectations, refusal self-efficacy, days use beer, days use liquor, days use alcohol of any type, days binge, weekly use, and negative alcohol effects are below the .40 level stipulated as part of this study for supporting convergent validity. The correlations between 'Planning' PBS and protection self-efficacy and drunkenness avoidance self-efficacy both have correlation greater than .40 and thus exhibit convergent validity.

Because the part and partial correlations did not include the direction of the relationship, it was necessary to also examine the betas. The betas closely resemble a correlation coefficient with the values ranging from -1 to 1 and can therefore be used to understand the direction of the relationships (Hair, 1998). By examining the sign of the betas, it was then possible to understand more fully the relationship between the variables. A negative beta means that as one variable increases in value, the other variable decreases in value. A positive beta means that as one variable increase in value, the other variable also increases in value and vice versa. Because the PBS items are based on harm reduction principles, it was thought that as the use of PBS increases, the

use of alcohol and the negative effects of alcohol would decrease. Based on the effect of expectations and efficacy on behaviors, it was thought that as alcohol abstinence expectations and efficacy increases, the use of PBS would also increase. Based on the data, these relationships were supported. As the summed scores for expectations and all efficacy scales increased, so did the use of PBS as evidenced by positive betas. Furthermore, as supported by negative betas, as use of PBS increases, use of alcohol decreases and the negative alcohol effects also decreased (Table 4.29).

Table 4.29. Multivariate Linear Regression with Final PBS Sub-scales

	Planning PBS						Execution PBS					
	B	Partial Correlation	Semi-Partial Correlation	*p* value	*n*	DF	*B*	Partial Correlation	Semi-Partial Correlation	*p* value	*n*	DF
Alcohol abstinence expectations	.301	.249	.246	<.001	318	6	.075	.066	.064	.243	318	6
Refusal self-efficacy	.497	.370	.365	<.001	319	6	.607	.479	.462	<.001	319	6
Protection self-efficacy	.578	.423	.417	<.001	319	6	.541	.421	.406	<.001	319	6
Drunkenness avoidance self-efficacy	1.160	.454	.448	<.001	319	6	1.188	.494	.477	<.001	319	6
Days use beer	-.043	-.235	-.222	<.001	316	6	-.091	-.467	-.442	<.001	316	6
Days use liquor	-.027	-.158	-.157	.005	314	6	-.082	-.437	-.435	<.001	314	6
Days use alcohol of any type	-.043	-.235	-.231	<.001	311	6	-.090	-.467	-.458	<.001	311	6
Days binge	-.036	-.224	-.213	<.001	316	6	-.083	-.479	-.456	<.001	316	6
Weekly use	-.223	-.275	-.265	<.001	319	6	-.493	-.573	-.552	<.001	319	6
Negative alcohol effects	-.299	-.308	-.304	<.001	319	6	-.457	-.443	-.438	<.001	319	6

Chapter 5: Discussion

The aims of this study were to examine the dimensionality, reliability and validity of the PBS scale among a sample of undergraduate college student drinkers. Most of the PBS items were taken from existing self-report surveys and a few others were created based upon focus group discussions with college freshmen. Three hundred and twenty college students provided self-report data utilized for this study during a fall academic semester. This chapter presents a discussion of the study results including results of each of the research questions. Also included in this chapter are the limitations and implications of this study as well as recommendations for future research. Findings related to the research questions are discussed first.

Interpretation of the PBS Dimensionality, Reliability and Validity Testing

The first aim of the study was to examine the dimensionality of the PBS scale to determine whether the PBS items represented a common construct or separate constructs. The second aim of the study was to determine the internal consistency of the PBS sub-scales. It was hypothesized that the PBS items would represent a similar construct and that three related (and reliable) PBS sub-scales would emerge from the PCA. Principal Components Analysis (PCA) was utilized to conduct exploratory factor analysis of the 22 PBS items. Through a series of PCA, orthogonal Procrustes rotations, and examination of the residual matrices, item-total correlations and Cronbach's alpha coefficients of the resulting factors, a two–factor solution was found to be the most comprehensive, interpretable, and reliable solution. Because the unique study sub-samples resulted in varying factor structures, the Procrustes method was utilized to account for the

differences in gender and race and to create sub-scales that would be applicable to all sub-samples of the study sample. While a two-factor solution was retained and guided the formation of two PBS sub-scales, it was plausible that the five deleted items could had been retained and that a different factor-structure could had been obtained with further manipulation of the factors. However, a goal of this study was to identify the best factor structure for all types of students including males, females, whites and non-whites. Therefore, while the four- or three-factor structure may have been supported for the male and female samples, it was important to identify the best fitting solution for all samples. While it was hypothesized that three sub-scales would emerge from the dimensionality testing, only two sub-scales resulted from this study that were reliable, fit all subsamples of the study, and rendered results through construct validity testing that suggested they had unique meaning and relationship with key alcohol-related variables of interest (described below).

The final PBS scale structure included two related sub-scales with the first comprised of nine PBS items and the second factor being comprised of eight PBS items. The first sub-scale was named 'Planning' PBS while the second sub-scale was named 'Execution' PBS. The Planning PBS items included the items which students would have to engage in prior to or at the beginning of their drinking experience. It was thought that the Planning PBS items captured a phenomenon in which students would have to think about and have some level of intention related to their protective behaviors. The Execution PBS items included the items which students would engage in during their actual alcohol use. Therefore it was thought that the Execution PBS items capture a

phenomenon in which students wouldn't necessarily have to plan their actions but rather have the knowledge, motivation and ability to protect themselves while drinking.

Reliability analyses were utilized during the dimensionality analyses to help determine the best factor structure. Once the two sub-scales were determined via dimensionality analysis, the internal consistency of the sub-scales was examined. The Cronbach's alpha coefficients (> .80) and item-total correlations (>.40) supported acceptable internal consistency for each of the PBS sub-scales for the total sample as well as for the male sample, female sample, white sample, and non-white sample. Additionally, the test-retest reliability was examined to determine the stability of the PBS sub-scales. Survey data were utilized that were collected about 4 months apart. The two final summed PBS sub-scale scores were correlated with each other and showed acceptable test-retest reliability (correlation coefficient >.40).

The third aim of this study was to examine the construct validity of the PBS sub-scales with the variables of interest (alcohol abstinence expectations, self-efficacy, alcohol use, and negative alcohol effects). Therefore, the PBS sub-scales were examined for construct validity while controlling for the effects study condition, living-learning membership, gender and race. Gender and race were controlled for so that the unique relationship between the PBS sub-scales and the other variables of interest would be highlighted and not confounded by the impact of gender and race. The Planning and Execution PBS sub-scales were highly correlated with each other indicating that both sub-scales do in fact measure a similar construct. The Planning PBS sub-scale was shown to correlate with (R> .40) protection self-efficacy and drunkenness avoidance self-efficacy suggesting that those students who had high levels of confidence in their ability

to protect themselves when drinking and to avoid drinking too much did in fact utilize more of those items included in the Planning PBS sub-scale. The strength and direction of these relationships was as expected thus providing support for construct validity. The Planning PBS were not shown to be highly correlated with alcohol abstinence expectations, refusal self-efficacy, all alcohol use items, and negative alcohol effects between the Planning PBS items and these predictors and outcomes. These relationships were unexpectedly weak and thus tended to weaken evidence for construct validity of this sub-scale.

The Execution PBS sub-scale was shown to be highly correlated with (> .40) all variables except alcohol abstinence expectations. Examination of the direction of these relationships suggests that those students who utilized more Execution PBS also reported higher levels of self-efficacy (refusal, protection, and drunkenness avoidance), less consumption of alcohol, and less experiences with negative alcohol-related effects. These high correlations and directionality of the relationships was as expected confirming the protective quality of the behavioral strategies with relation to alcohol-related outcomes and providing support for the construct validity of this PBS sub-scale.

Relationship of the Findings to the Recent Literature

The findings of this study are different than the results of previous studies (Benton et al., 2004; Martens et al., 2004; Delva et al., 2004) in a variety of ways. First, this study included a composition of previously used PBS items as well as items created for the parent study. Second, this study examined the gender and racial influences on the scale development of the PBS items. Third, this study examined the PBS sub-scales as

outcomes as well as predictors whereas other studies have only utilized PBS as predictors of alcohol use and negative consequences. While the relationship between using certain PBS and the experiences with alcohol and the negative alcohol-related effects in this study was consistent with previous studies, the factor structure for the PBS in this study was different than the factor structure in previous studies.

Benton et al. (2004) and Denton et al. (2004) included PBS items from two different surveys. Benton et al. (2004) examined 10 items from the Campus Alcohol Survey and found significant relationships with the use of PBS and experiencing alcohol-related consequences. Denton et al. (2004) examined 10 PBS items from the National College Health Assessment and found similar results as Benton et al. (2004). Each of the previous three studies have lumped the PBS items into a single scale. More recently, two articles had been published which report findings from the examination of a PBS or related scale. Martens, Ferrier, and Cimini (2007) expanded on their preliminary research constructing a PBS scale (Martens et al., 2005). Martens and others (2005) utilized factor analysis and found that a15-item PBS scale resulted in three related sub-scales. The three sub-scales were named Limiting/Stopping Drinking, Manner of Drinking, and Serious Harm Reduction. However, one sub-scale had an acceptable Cronbach's alpha coefficients, and two sub-scales had less than acceptable Cronbach's alpha coefficients. The alpha levels were .81, .73, and .63 respectively. Based on these preliminary findings, confirmatory factor analysis was conducted to further examine the psychometric properties of the three sub-scales and the overall PBS scale. The authors utilized 505 undergraduate students from two universities. A small percentage (27.5%) of the students was volunteers while the remaining participants were judicially mandated

to perform some type of alcohol sanction. All data were collected online from the student participants, and the 15-item PBS items were included with response options ranging from never to always. The authors determined through confirmatory factor analysis and maximum likelihood estimation procedures that a three-factor PBS scale was supported. Additionally, all three sub-scales were related to each of other as well as were correlated in the expected direction with alcohol use and alcohol-related problems. However, the Cronbach's alpha coefficients were again rather low for two of the sub-scales. The alpha levels were .82, .74, and .59 respectively for the Stopping/Limiting Drinking, Manner of Drinking, and Serious Harm Reduction sub-scales.

Sugarman and Carey (2007) utilized a briefer version of the Self-Control Questionnaire originally developed by Werch (1990) to examine the relationship between the self-control strategies (SCS) with alcohol use. Sugarman and Carey included 247 undergraduate students who had self-reported recent alcohol use and who responded to twenty-one SCS in their cross-sectional study. The authors again utilized factor analysis to examine the dimensionality of the SCS, and the PCA results resulted in a three-factor solution with those three factors having acceptable reliability (ranging from .76 to .82). The three sub-scales were named Selective Avoidance, Strategies While Drinking, and Alternatives and were related to alcohol use in the expected direction.

In summary, the recent literature indicates that these PBS/self-control measures are in fact reliable, and valid in terms of predicting alcohol use. The evidence highlighted in these recent studies as well as the results from this study, indicated that while reliable and valid versions of PBS scales may be at hand, the best version of this construct has not yet been determined. The results from these two recent studies are

different than what resulted from this study. This study resulted in a single PBS scale with two related sub-scales whereas these two recent studies resulted in a single PBS scale with three related sub-scales. Therefore, more research is needed to confirm the dimensionality of a PBS scale with diverse groups of college students and to further understand the validity of the PBS scale.

Limitations

There were a number of limitations associated with this study. First, the sampling frame utilized in the parent study was a purposive sample frame to assure balance across the wings of students on gender and living-learning status, not a randomly selected sample of all students on the campus suggesting that there may be a generalizability bias. However, the study sample demographics and the university's demographics were closely related suggesting that the generalizability issue may not be a fatal limitation in this study that could devalue the results.

Second, the data collected was self-reported by college students. Therefore, the reliability of the survey data is dependent on the students' honesty and completeness of their responses. To minimize this self-report bias, all data were initially checked for completeness and reliability. Those cases shown to be missing entire sections of data or data with little to no variability were deleted. Because of these measures, the final set of data was reliable and as complete as possible, and there is confidence in the final datasets utilized in this study. Furthermore, the 'drinker' status utilized to narrow this study sample was based on the students' self-reported alcohol use in the thirty days prior to survey completion. While multiple items were used to determine the 'drinker' status for

each student, some students may have not been included in this category who should had been and vice versa resulting in a dataset that did not reliably capture all college student drinkers. Therefore, the results of this study are only based on those students included in the final database, and this sample may be a biased sample of drinkers. In addition to the reliability of the self-report data, the students also initially self-selected themselves into the parent study by logging onto the survey website and completing the survey. Based on this self-selection bias, there was an under-representation of males and non-living learning students in the study sample. Because of the limited sample due to recruitment on a single college campus with a preponderance of white students, the results of this study may not be generalized to other college student population and to the young adult, non-college attending, population in general America. Additionally, the comparison between the white and non-white samples should be considered exploratory due to the small non-white sample. Finally, the lumping of all non-white students into a single category may pose bias and caution should be used when interpreting this category.

Third, this study is based on cross-sectional data collected about two months into the fall academic semester at a large mid-Atlantic university. Therefore, there is an inability to identify the causality in the relationships between the PBS sub-scales and the other variables of interest. This timing of survey administration may have implications on the study findings because of the alcohol-related situations college students experience as a result of living on campus. Also, the timing of the second follow-up survey administration may be a factor in the low test-retest reliability. Fourth, the PBS items were asked of students in two different sections on the web-based survey. Those items which the researchers thought were directly associated with drinking alcohol were only

asked of students who self-reported recent alcohol use. Students were directed to respond to those fourteen items with the following lead-in statement, "How often did you do the following since arriving at UM for the Fall 2006 semester?" The remaining nine PBS items were asked of all students completing the web-based survey regardless of their current drinking status. A different lead-in statement was used for this section of PBS items and stated, "Since arriving at UM for the Fall 2006 semester, when you socialized with others, how often did you…?" Because of the discrepancy between the lead-in statements and the absence of framing the last nine PBS items in the context of drinking environments, the students may have responded differently to the two sets of items. If the wording of the lead in statements had been the same, the items may have loaded more highly in the dimensionality analysis thus resulting in their retention in the final scale factors.

Finally, in addition to the variations in the wording of the PBS lead-in statements, there was also a discrepancy in the self-efficacy items. The drunkenness avoidance and protection self-efficacy items were created by the parent study's research staff. These drunkenness avoidance and protection self-efficacy items were worded to closely reflect students' confidence in performing specific PBS items, whereas the refusal self-efficacy items were not worded to closely reflect specific PBS behaviors. Additionally, the drunkenness avoidance and protection efficacy items were asked in the context of how confident the student was regarding the efficacy items when with their wing-mates. Therefore, the wing-mate efficacy items were used as proxies for self-efficacy in general alcohol situations in this study.

Summary and Implications of the Current Study

This study was conceptualized because of a gap in the literature regarding the dimensionality, reliability, and validity of a protective behavioral strategies scale. The PBS items (theoretically related to each other) had been utilized in previous studies without adequate scale development. Furthermore, no standard set of PBS items was located in the literature suggesting a need for a standardized scale that has been put through rigorous dimensionality, reliability, and validity testing. Additionally, the scarce scale development analysis conducted with those PBS items found in the literature did not focus on specific sub-samples of college students. Therefore, this study aimed to further explore the dimensionality, reliability and validity of a compiled list of PBS items as well as to examine the gender and racial differences in the PBS scale (and sub-scales). Because the gender and racial differences of the PBS scale had not previously been examined, it was important to utilize analytic procedures to accommodate these sample differences. Therefore, the Procrustes orthogonal rotation method was utilized to provide further dimensionality support and to identify the best scale structure for all samples. Finally, the PBS items had only previously been used in studies to examine the relationship between PBS and alcohol consumption and negative alcohol-related effects. This study looked to provide further support for the relationship of the PBS items with alcohol outcomes but also to explore the relationship of the PBS items with expected behavioral antecedents as well. Therefore, expectations and efficacy items were included in this study to provide support for the validity of the PBS items. It is understood that the extensibility of the PBS measure (and individual sub-scales) to other samples may be at the risk of losing some predictive ability for alcohol-related outcomes. However, a goal

of this study was not to examine the predictive power or predictive validity of the PBS sub-scales with relation to the variables of interest. Rather, a preliminary examination of the relationships between the PBS sub-scales and the alcohol-related variables of interest was the focus.

Based on the literature and on face validity, it was thought that the PBS items would represent a single construct but with three distinct but related sub-scales. In terms of validity, it was thought that the three sub-scales would be uniquely related to separate predictors and outcomes based on the context by which the PBS items represented, for example: strategies to avoid alcohol, strategies to drink more responsibly, and strategies to maintain a safe environment. The final results from this study are different than what has been presented in the literature and what was hypothesized when this study was conceptualized. As indicated by the study findings, the final PBS scale is bi-dimensional, reliable, and valid in certain contexts. The scale was developed via repeated PCA utilizing the Procrustes orthogonal rotation method to account for the sample differences. The Planning PBS sub-scale was comprised of nine items which included cognitive behaviors students would engage in prior to or during drinking. The Execution PBS sub-scale was comprised of eight items that dealt with physical behaviors students would engage in during their partying or socializing experiences. Each of the sub-scales was psychometrically tested and derived from analyses and was thus presumably appropriate for use with each of the college student sub-samples included in this study (all students, males, females, whites, and non-whites). During the examination of the internal consistency of the sub-scales, each sub-scale had high Cronbach's alpha coefficients

across all five samples. Furthermore, the sub-scales exhibited acceptable stability over time via test-retest reliability analysis.

The Execution PBS sub-scale was highly correlated to the Planning PBS sub-scale supporting validity of the overall PBS construct and suggesting that the final 17 PBS items can be used as a general indicator of protective strategies in addition to the use of the specific sub-scales. The results suggest that the sub-scales are in fact related and measure two dimensions of the same construct (protective behaviors) rather than measuring two distinct constructs.

Given that the sub-scales that emerged from the dimensionality and reliability testing were different than what was originally hypothesized, the results from the third aim of this study to examine the validity of the sub-scales had to stand alone. However, based on the dimensionality of the PBS scale, it was thought that the Planning PBS sub-scale would be highly correlated with the alcohol abstinence expectations, the efficacy measures and the alcohol use measures. It was also thought that the Execution PBS sub-scale would be highly correlated with the efficacy measures and the alcohol-related outcomes (use and negative effects).

The validity results are different than what would be expected given the dimensionality of the PBS scale. It would be expected that the Planning PBS would be highly correlated with the alcohol abstinence expectations and the alcohol use outcomes, when in fact this was not shown. The Planning PBS sub-scale was shown to correlate with the protection and drunkenness avoidance efficacy scales but no other variables of interest. The relationships between the Planning PBS sub-scale with protection and drunkenness avoidance self-efficacy was high and the direction of the relationships were

in the expected direction. However, the Execution PBS sub-scale was related to the variables as expected. The Execution PBS sub-scale was shown to be correlated with efficacy and alcohol-related outcomes but it did not show adequate correlations with alcohol abstinence expectations thus providing support for predictive validity. These relationships also provide support for validity across samples and based on the correlational relationships between the PBS sub-scales and the specific variables of interest as explained previously.

The Planning PBS could be considered drinking intentions or motivations whereas the Execution PBS measured behaviors actually performed. Because the Planning PBS sub-scale was only shown to be correlated with protection and drunkenness avoidance self-efficacy, it does not appear to have convergent validity regarding decreased alcohol use and related outcomes although this was not tested longitudinally. Because the Execution PBS sub-scale was related to the efficacy items as well as the alcohol-related outcomes, it was suggested that the Execution PBS does appear to have convergent validity regarding decreased alcohol use and related outcomes although this was not tested longitudinally. Therefore, the Execution PBS sub-scale could actually stand alone (rather than be used in conjunction with the Planning PBS sub-scale) if the goal of the research is to reduce alcohol-related outcomes. While these study results can suggest use of the Execution PBS in studies addressing alcohol-related behaviors, further validation of the sub-scales and examination of the relationships between PBS and alcohol-related items is necessary.

Based on the analytic procedures utilized in this study, the PBS sub-scales can be applied to all types of college student drinkers as supported via the repeated PCA and

Procrustes rotation methods as well as high internal consistency across samples. In addition to the focus on different sub-groups of college students in this study, one other significant contribution of this study is the examination of the PBS sub-scales as outcomes of interest, not just predictors of alcohol-related outcomes. Given the relationship between the Execution PBS sub-scale and the self-efficacy predictors, it may be productive for future research to more fully address development of students' confidence in limiting their drinking or protecting themselves while drinking. The results from this study also suggest that a focus on skills related to drinking responsibly may be an area warranting further attention due to the high correlations between refusal, protection, and drunkenness avoidance self-efficacy and the Execution PBS sub-scale. The relationship between the Execution PBS and alcohol related outcomes suggest that Execution PBS-based interventions may promote harm reduction related to alcohol use. If future research goals focus on alcohol reduction (rather than abstinence), the Planning PBS may not result in significant reductions in alcohol use (or alcohol-related effects) as evidenced by the correlations from this study. However, because the Execution PBS sub-scale was shown to be correlated not only with alcohol use outcomes but also negative alcohol-related effects, future research may want to focus on Execution PBS-based activities and programmatic efforts to maximize the effects of the intervention on specific alcohol-related behaviors. Furthermore, the individual PBS items that comprised the Execution PBS sub-scale may be useful for interventions to focus. By utilizing Execution PBS-based interventions, the intervention would be tailored and specific and could effectively and efficiently have an impact on alcohol-related outcomes.

However, these PBS items (and sub-scales) need to be examined in larger, more diverse college populations as well as non-college populations to test the external validity of these PBS sub-scales. Upon further testing and additional support, the PBS could be incorporated into college alcohol prevention studies as both behavioral outcomes and as a measure of mechanisms to help limit alcohol consumption and the negative alcohol-related effects experienced by many college student drinkers. The results from this study may also help researchers better understand alternatives to alcohol-abstinence approaches.

Recommendations for Future Research

Because this study was only an exploratory study to examine the dimensionality of the compiled PBS items, confirmatory factor analysis is needed to verify the factor structure, especially for the different sub-samples as indicated in this study. More research is also needed to be able to fully understand the relationships between the PBS and alcohol-related outcomes among college students and other drinkers in the general population (non-college attending). The PBS sub-scales should be tested with students on more ethnically diverse campuses to support the relationship of PBS and alcohol-related outcomes with all college students. The PBS needs to be examined as a behavioral outcome and further examination is needed to better understand the relationship between PBS and efficacy items. This study was the first to introduce PBS as a behavioral outcome, and both of the PBS sub-scales were related to specific efficacy items. Therefore, the results from this study warrant the expansion of examining the PBS measure (and the specific PBS sub-scales) not only as a predictor of alcohol-related

outcomes but also as a behavioral outcome that can be predicted by specific motivational or attitudinal variables. Additionally, more research is needed to fully clarify the differences between the PBS sub-scales with relation to alcohol-related outcomes to verify if in fact the Execution PBS sub-scale may be able to stand alone when measuring alcohol-related behaviors. While this study was not meant to identify the most parsimonious predictive model, it was necessary for longitudinal intervention studies utilizing multivariate analyses to be conducted to further test the predictive validity of PBS to fully understand the causal relationship between efficacy and PBS as well as the causal relationship between PBS and alcohol-related outcomes.

Conclusions

The PBS does represent a reliable and valid bi-dimensional scale. This study has provided additional support for the establishment of a standard PBS construct; however, more research is needed to further validate the relationships identified in this study. The Execution PBS sub-scale was shown to be highly correlated with all alcohol-related variables of interest except for alcohol abstinence expectations. The Planning PBS sub-scale was shown to be highly correlated with the protection and drunkenness avoidance self-efficacy predictor variables. The Planning PBS sub-scale was not highly correlated with alcohol abstinence expectations, refusal self-efficacy, alcohol use, and negative alcohol effects. Based on the high correlations of the sub-scales with particular alcohol-related variables and given the directionality of the relationships, construct validity of the Execution PBS was fully supported whereas the Planning PBS was partially supported. These differences with regards to the relationships between the PBS sub-scales with the

alcohol-related variables require more attention but may suggest distinct applicability uses of the sub-scales. If the goal is to reduce alcohol related outcomes, the Planning PBS was not shown to be highly correlated with these outcomes and may not be relevant. As shown in this study, the Execution PBS sub-scale was shown to be highly correlated with alcohol-related outcomes and could be relevant in studies focused on this outcome. It was suggested that maybe the Execution PBS sub-scale could stand alone in studies looking to reduce alcohol-related outcomes based on these results. However, additional research is needed to fully understand the use of PBS as behavioral outcomes and to further validate the use of the Planning PBS sub-scale. Additionally, the results from this study suggest that the use of Execution PBS-based interventions may reduce alcohol-related outcomes (consumption and negative effects) and that increased efficacy could possibly be related to the increased PBS-based behaviors. The next steps for research into a PBS scale would be to further establish the dimensionality, reliability, and validity of the PBS scale and sub-scales in other populations. This study contributes to parallel research attempting to identify a definitive, standardized measure of PBS.

Appendices
Informed Consent/Assent: Implementation

Identification of Project: Peers as Family.

Statement of age of subject: I understand that I must be at least 17 years of age to participate in this research. If I am 17 years of age, then I assent to this research as a minor. If I am over 17 years of age, then I consent to this research as an adult. My assent or consent indicates that I wish to participate in this program of research being conducted by Bradley O. Boekeloo, PhD, MS in the Department of Public and Community Health at the University of Maryland, College Park, MD 20742 (Telephone: 301-405-8546).

Purpose: The purpose of this research is to investigate methods to improve health and safety of college students.

Procedures: As a study participant, I understand that I will be emailed and asked to complete either an online web-based or paper survey, once in the middle of Fall and Spring semester. I will receive an email link and password for each on-line survey. If I do not complete the on-line survey, then I will be mailed a paper copy of the survey and return mail envelope so that I can complete it and return it via campus mail. The surveys will ask me about my knowledge, attitudes and behaviors related to alcohol use. I agree to complete all study surveys in private, without anyone else watching me. I also agree to the release of notification of my participation in resident hall workshops to the researchers for this project. The research team will review the University Police records to determine if I have had any alcohol-related citations and I consent to the release of this information. They will review Residence Life records to determine if I have had alcohol-related medical emergencies and I consent to the release of this information. Finally, the research team will search the Registrar's records and will obtain information from my academic transcripts and I consent to the release of this information. The data obtained from these outside sources will be used to assess the effect of alcohol on student life. I understand that in the event I leave UMCP, I will no longer be eligible for the study.

Confidentiality: The research staff is committed to protecting my privacy, and the information I provide will be treated confidentially. My name will not appear on the survey or other data about me. I agree to complete the survey privately without discussing it with anyone or allowing anyone to look at my answers. I understand that no attempt will be made to match my name with my survey responses or any other information that is collected about me. All information that I provide and all information that is collected will identify me by a unique study identification number that is not my university identification number or social security number. To link each of my surveys and my police and university records, the researchers must match my study identification with my identity but the list that matches my study identification with my identity will be directly protected and supervised by Dr. Boekeloo. It will be destroyed as soon as data collection is completed (within two years). I understand that while my name and student identification number will be used to search Police and University records, any information that is collected about me by the researchers will be identified by a unique study identifying number (a new number assigned by the research team and not my university ID or social security number) and no identifying information (name, university ID, social security number) will appear with this information. All information about me with my study identification numbers will be kept in locked cabinets in the locked offices of Dr. Boekeloo or in password protected computer files of Dr. Boekeloo. The data I provide will only be used for scientific reporting, and data will always be presented in the aggregate.

The research staff has also obtained a Confidentiality Certificate (CC) from the US Department of Health and Human Services (DHHS) to protect the researchers from being forced, even by court order or subpoena, to identify me. (The Certificate does not imply approval or disapproval of the project by the Secretary of DHHS. It adds special protection for the research information about me.) I know that researchers may provide information to appropriate individuals or agencies if harm to myself, harm to others, or if information about child abuse is disclosed. In addition, the federal agency funding this research may see my information if it audits the research staff.

Risks: I may feel uncomfortable answering questions about my alcohol use. The researchers will protect my confidentiality as stated above but inadvertent disclosure of my identity, particularly related to illegal behaviors, could cause me embarrassment or legal problems. The only cost to me for participating is my time.

Right to Withdraw: I may refuse to answer any question and I may choose not to respond to specific questions. I may withdraw from the study at any time, without penalty.

Benefits: I understand that this study is not designed to help me personally but that the investigators hope to learn more about preventing adverse consequences of alcohol use among college students. If the researchers learn that I am in danger from alcohol use, the researchers may call me to advise me about my risk of harm and that I should contact a health professional.

Incentives: I understand that I will receive a $10 University Book Center coupon for completing and submitting each survey. The coupon is to let me know that my help in this study is important and appreciated. Also, if 85% of the residents in my residence hall wing participate, then for each survey, my wing will be entered into a raffle and the winning wing participants will each receive a $20 gift certificate.

Where medical care is available: In the event that I suffer psychological stress from my participation in this study I understand that the University Health Center has support programs regarding these issues if I desire further information. However, I understand that the University of Maryland does not provide any medical or hospitalization insurance coverage for participants in the research study nor will the University of Maryland provide any compensation for any injury sustained as a result of participation in this research except as required by law.

If I have questions about my rights as a research subject or wish to report a research-related injury, I will contact: Institutional Review Board Office, University of Maryland, College Park, Maryland, 20742; (e-mail) irb@deans.umd.edu; (telephone) 301-405-4212. **By entering my study ID number, birthdate, and today's date below, I signify that I have read and understand this assent/consent from and am willing to participate in this study. The study ID entered below must match the number that has been provided on the top right corner of the first page of the survey.**

Bradley O. Boekeloo, PhD
Professor
Public & Community Health
University of Maryland
College Park, MD 20742
301.405.8546

Subject's Study ID Number_____

Subject's Date of Birth_____

Today's Date_____

Bibliography

Abdi, H. (2003). *Factor Rotations in Factor Analyses*. *Encyclopedia of Social Sciences Research Methods.* Lewis-Beck, Byrman, & Futing (eds). Thousand Oaks (CA): Sage.

American College Health Association. 2006 Reference Group Executive Summary (on-line). Available at: http://www.acha-ncha.org/docs/ACHA-NCHA_Reference_Group_ExecutiveSummary_Spring2006.pdf. Accessed: February 23, 2007.

American College Health Association. (2005). The ACHA National College Health Assessment, Spring 2003 Reference Group Report. *Journal of American College Health, 53*(5), 199.

Bandura, A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory.* Englewood Cliffs, New Jersey: Prentice Hall.

Becker, Agopian, & Yeh. (1992). Impact evaluation of Drug Abuse Resistance Education (DARE). *Journal of Drug Education, 22*(4), 283-91.

Benton, S.L., Schmidt, J.L., Newton, F.B., Shin, K., Benton, S.A., & Newton, D.W. (2004). College student protective strategies and drinking consequences. *Journal of Studies on Alcohol, 65*;115-21.

Blume, A.W., Schmaling, K.B., & Marlatt, A.G. (2003). Predictors of change in binge drinking over a 3-month period. *Addictive Behaviors, 28*; 1007-12.

Bonnie, R.J., & O'Connell, M.E. (Eds). *Reducing Underage Drinking: A Collective Responsibility*. Washington, DC: The National Academy Press; 2004

Bonomo, Y., & Bowes, G. (2001). Putting harm reduction into an adolescent context. *Journal of Pediatrics and Child Health, 37*; 5-8.

Bryant, F. B., & Yarnold, P.R. (2000). Principal-components analysis and exploratory and confirmatory factor analysis. In L.G. Grimm and P.R. Yarnold (Eds.), *Reading and understanding multivariate statistics.* Washington D.C.: American Psychological Association.

Castro, R.J., & Foy, B.D. (2002). Harm reduction: A promising approach for college health. *Journal of American College Health, 51*(2), 89.

Centers for Disease Control and Prevention. (2006). Youth Risk Behavior Surveillance—United States, 2005. MMWR Surveillance Summaries, 55(SS05), 1-108.

Centers for Disease Control and Prevention. (1997). Youth Risk Behavior Surveillance: National College Health Risk Behavior Survey—United States, 1995. MMWR Surveillance Summaries, 46(SS-6), 1-54.

Clark, L.A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment, 7*(30); 309-19.

CORE Institute, Southern Illinois University. 2006 Core Alcohol and Drug Survey Results (on-line). Available at: http://www.siu.edu/~coreinst/. Accessed: February 23, 2007.

Delva, J., Smith, M.P., Howell, R.L., Harrison, D.F., Wilke, D., & Jackson, L. (2004). A study of the relationship between protective behaviors and drinking consequences among undergraduate college students. *Journal of American College Health, 53*(1); 19-26.

Department of Health and Human Services: Substance Abuse and Mental Health Services Administration. Office of Applied Studies. Results from the 2004 National Survey on Drug Use and Health: National Findings. Rockville, MD.

DeVellis, R.F. (2003). *Scale Development – Theory and Applications* (v 26). Thousand Oaks, CA: Sage.

Di Iorio, C.K. (2005). *Measurement in Health Behavior: Methods for research and evaluation.* San Francisco, CA: John Wiley & Sons, Inc.

Dickson, L.M., Derevensky, J.L., & Gupta, R.. (2004). Harm reduction for the prevention of youth gambling problems: Lessons learned from adolescent high-risk behavior prevention programs. *Journal of Adolescent Research, 19*(2), 233-263.

Downey, R.G., & King, C.V. (1998). Missing data is likert ratings: A comparison of replacement methods. *The Journal of General Psychology, 125*(2); 175-91.

Duncan, D.F., Hawkins, W., Petosa, R., Nicholson, T., & Clifford, P. (1994). Harm reduction: An emerging new paradigm for drug education. *Journal of Drug Education, 24*(4), 281-90.

Engels, R.C.M.E., Weirs, R., Lemmers, L., & Overbeek, G. (2005). Drinking motives, alcohol expectancies, self-efficacy, and drinking patterns. *Journal of Drug Education, 35*(2); 147-66.

Ennett, S.T., Flewelling, R.L., Tobler, N.S., & Ringwalt, C.L. (1994). How effective is Drug Abuse Resistance Education? A meta-analysis of project DARE outcome evaluations. *American Journal of Public Health, 94*(9), 1394-1401.

Fishbein, M. & Ajzen, I. (1972). Attitudes and opinions. *Annual Review of Psychology, 23*, 487.

Fisher, Fisher, Misovich, Kimble, & Malloy. (1996). Changing AIDS risk behavior: Effects of an intervention emphasizing AIDS risk reduction information, motivation, and behavioral skills in a college student population. *Health Psychology, 15*(2), 114-23.

Floyd, F.J., & Widaman, K.F. (1995). Factor analysis in the development and refinement of clinical assessment instruments. *Psychological Assessment, 7*(3); 286-99.

Fromme, K., & Corbin, W. (2004). Prevention of heavy drinking and associated negative consequences among mandated and voluntary college students. *Journal of Consulting and Clinical Psychology, 7*2(6); 1038-49.
Fromme, Stroot, Caplan. (1993).

Gilles, D.M., Turk, C.L., & Fresco, D.M. (2006). Social anxiety, alcohol expectancies, and self-efficacy as predictors of heavy drinking in college students. *Addictive Behaviors, 31*; 388-98.

Glassman, T., Werch, C., & Jobli, E. (2007). Alcohol self-control behaviors of adolescents. *Addictive Behaviors, 32*; 590-7.

Graham, J.W., Tatterson, J.W., Roberts, M.M., & Johnston, S.E. (2004). Preventing alcohol-related harm in college students: Alcohol-related Harm Prevention program effects on hypothesized mediating variables. *Health Education Research, 19*(1); 71-84.

Griffin, K.W., Scheier, L.M., Botvin, G.J., & Diaz, T. (2000). Ethnic and gender differences in psychological risk, protection and adolescent alcohol use. Prevention Science, 4*; 199-212.*

Gorsuch, R.L. (1983). *Factor Analysis* (2nd Ed). L. Erlbaum Associates. New Jersey.

Hair, J.F., Anderson, R.E., Tatham, R.L., & Black, W.C. (1998). *Multivariate Data Analysis* (5th Ed). Prentice Hall. New Jersey.

Ham, L.S., & Hope, D.A. (2003). College students and problematic drinking: A review of the literature. *Clinical Psychology Review, 23*; 719-759.

Hingson, R., Heeren, T., Winter, M., & Wechsler, H. (2005). Magnitude of alcohol-related mortality and morbidity among U.S. college students ages 18-24: Changes from 1998 to 2001. *Annual Review of Public Health, 26*, 259-79.

Hingson, R.W., Heeren, T., Zakocs, R.C., Kostein, A., & Wechsler, H. (2002). Magnitude of alcohol-related mortality and morbidity among U.S. college students ages 18-24. *Journal of Studies on Alcohol, 63*; 136-44.

Howard, D.E., Boekeloo, B.O., Griffin, M.A., Lake, K., & Bellows, D. (2007). Staying safe while consuming alcohol: A qualitative study of the protective strategies and informational needs of college freshmen. *Journal of American College Health, 56*(2).

Inkelas, K.K., Brower, A.M., Crawford, S., Hummel, M., Pope, D., & Zeller, W.J. (2004). National Study of Living-Learning Programs. 2004 Report of Findings. Retrieved February 23, 2007, from http://www.livelearnstudy.net/images/NSLLP_2004_Final_Report.pdf.

Johnston, L.D., O'Malley, P.M., Bachman, J.G., & Schulenberg, J.E. (2005). Monitoring the Future: National results on adolescent alcohol use. Overview of Key Findings, 2005.

Kachigan, S.K. (1991). *Multivariate Statistical Analysis: A Conceptual Introduction* (2nd ed). New York: Radius Press.

Kuther, T.L. & Higgins-D'Alessandro, A. (2003). Attitudinal and normative predictors of alcohol use by older adolescents and young adults. *Journal of Drug Education, 33*(1); 71.

Leino, E.V. (2007, January 5). Personal email communication.

Marlatt, G.A., & Witkiewitz, K. (2002). Harm reduction approaches to alcohol use: Health promotion, prevention and treatment. Addictive Behaviors, 27; 867-86.

Marlatt, G.A. (1996). Harm reduction: Come as you are. Addictive Behaviors, 21(6); 779-88.

Marlatt, G.A., Somers, J.M., & Tapert, S.F. (1993). Harm reduction: Application to alcohol abuse problems. NIDA Research Monograph, 137; 147-66.

Martens, M.P., Ferrier, A.G., & Cimini, M.D. (2007). Do protective behavioral strategies mediate the relationship between drinking motives and alcohol use in college students? *Journal of Studies on Alcohol & Drugs, 68*(1); 106-114.

Martens, M.P., Ferrier, A.G., Sheehy, M.J., Corbett, K., Anderson, D.A., & Simmons, A. (2005). Development of the Protective Behavioral Strategies Survey. *Journal of Studies on Alcohol, 66*; 698-705.

Martens, M.P., Taylor, K.K., Damann, K.M., Page, J.C., Mowry, E.S., Cimini, M.D. (2004). Protective behavioral strategies when drinking alcohol and their relationship to negative alcohol-related consequences in college students. *Psychology of Addictive Behaviors, 18*(4), 390-3.

McBride, N., Farringdon, F., Midford, R., Meuleners, L., & Phillips, M. (2003). Early unsupervised drinking: Reducing the risks. The School Health and Alcohol Harm Reduction Project. Drug and Alcohol Review, 22(3)*; 263-76.*

Nunnally, J.C., & Bernstein, I.H. (1994). *Psychometric Theory* (3rd ed). New York: McGraw-Hill.

Oei, T.P.S., Hasking, P.A., Young, R.M. (2005). Drinking refusal self-efficacy questionnaire-revised (DRSEQ-R): A new factor structure with confirmatory factor analysis. *Drug and Alcohol Dependence, 78*; 297-307.

Ommundsen, R., Morch, S., Hak, T., Larsen, K.S., & Veer, K.V.D. (2002). Attitudes toward illegal immigration: A cross-national methodological comparison. *Journal of Psychology, 136*(1); 103.

Park, C.L. (2004). Positive and negative consequences of alcohol consumption in college students. *Addictive Behaviors, 29*; 311-21.

Peers as Family: Preventing Problem Drinking. (2005). Boekeloo, B.O., Principal Investigator. Funder: National Institutes of Alcohol Abuse and Alcoholism, Grant # R01AA015139-01A1.

Perkins, H.W. (2002). Surveying the damage: A review of research on consequences of alcohol misuse in college populations. *Journal of Studies on Alcohol, 14*; 91-100.

Reis, J., Trockel, M., Wall, A. (2003). Promoting student support for alcohol misuse prevention on campus: The role of secondhand consequences expectancies. *NASPA Journal*, 40(2); 59-73.

Rosenstock, I.M., Strecher, V.J., & Becker, M.H. (1988). Social Learning Theory and the Health Belief Model. *Health Education Quarterly, 15*(2); 175-83.

Sale, E., Sambrano, S., Springer, J.F., & Turner, C.W. (2003). Risk, protective, and substance use in adolescents: A multi-site model. *Journal of Drug Education, 33*(1); 91-105.

Sharp, M. (2005). From condoms to needles and everything in between. Shades of gray with harm reduction. *Positively Aware: The Monthly Journal of the Test Positive Aware Network, 16*(4), 20-1.

Schönemann, P.H., & Carroll, R.M. (1970). Fitting one matrix to another under choice of a central dilation and a rigid motion. *Psychometrika, 35*; 245-55.

Schönemann, P.H. (1966). A generalized solution of the orthogonal Procrustes problem. *Psychometrika, 31*; 1-10.

Single, E. (1996). Harm reduction as alcohol-prevention strategy. *Alcohol Health & Research World, 20*(4); 239.

Sugarman, D.E. & Carey, K.B. (2007). The relationship between drinking control strategies and college student alcohol use. *Psychology of Addictive Behaviors, 21*(3); 338-45.

Trochim, W.M.K. (2001). *The Research Methods Knowledge Base*. Cincinatti, OH.

University of Maryland, Office of Institutional (OIRP). Available at: https://www.irpa.umd.edu/menus.cfm?action=irreports. Accessed: March 27, 2007.

Upcraft, M.L. (2002). Today's first-year students and alcohol. Available at: http://www.collegedrinkingprevention.gov/SupportingResearch/upcraft1.aspx. Accessed: March 27, 2007.

U.S. Department of Health and Human Services. (2000*). Healthy People 2010 Objectives: Understanding and Improving Health.* 2nd Ed. Washington, D.C: U.S. Government Printing Office.

Walters, S.T., & Bennett, M.E. (2000). Drinking on campus. What do we know about reducing alcohol use among college students? *Journal of Substance Abuse Treatment, 19*(3), 223-8.

Wechsler, H., Lee, J.E., Nelson, T.F., & Kuo, M. (2002). Underage college students' drinking behavior, access to alcohol, and the influence of deterrence policies: Findings from the Harvard School of Public Health College Alcohol Study. *Journal of American College Health, 50*(5); 223-36.

Wechsler, H., Davenport, A., Dowdall, G., Moeykens, B., & Castillo, S. (1994). Health and behavioral consequences of binge drinking in college: A national survey of students at 140 colleges. *JAMA, 272*(21); 1672-77.

Weitzman, E.R., & Nelson, T.F. (2004). College student binge drinking and the "prevention paradox": Implications for prevention and harm reduction. *Journal of Drug Education, 34*(3); 247-65.

Werch, C.E. (1990). Behavioral self control strategies for deliberately limiting drinking among college students. Addictive Behaviors, 15; 119-28.